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The Canadian Engineer

ESTABLISHED 1893.

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CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE AND MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

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TORONTO, CANADA, JULY 30, 1909.

CONTENTS OF THIS ISSUE.

THE LEVEL CROSSING.

The Dominion Parliament at its last session amended the Railway Act by adding Section 239 A, which read as follows:—

> The sum of two hundred thousand dollars each year for five consecutive years from the first day of April, one thousand nine hundred and nine, shall be appropriated and set apart from the Consolidated Revenue Fund for the purpose of aiding in the providing by actual construction **work of protection,** safety and convenience for the public in respect of highway crossings of the railway at rail level in existence on the said first day of April.

The Act further provides that the money so spent shall be for actual construction, and shall not include maintenance or operation charges.

Subsection 3 of Section 239 A reads:—

> The total amount of money to be apportioned, and directed and ordered by the Board to be payable from any such annual appropriation shall not, in the case of any one crossing, exceed twenty per cent. of the cost of the actual construction work in providing such protection, safety and convenience, and shall not, in any such case, exceed the sum of five thousand dollars, and no such money shall in any one year be applied to more than three crossings in any one municipality or more than once to any one crossing.

To assist in designating the level crossings that are dangerous the Board are asking for reports from the railways as to the level crossings they consider especially dangerous.

It will be interesting to notice the haste with which such a list will be submitted by the railways. Such a list would likely entail the expenditure of half a million annually for five years by Canadian railways, and this expenditure will be made without hope of financial returns.

Some better system of selection must be tried. 'Tis true a list of crossings that have been the scene of one or more killings would be of interest, but there are many crossings that are "dangerous," and that could easily be removed which have not as yet been the scene of a fatal accident.

The object of this legislation, we take it, was to remove or protect level crossings at points where such protection was of public interest. A few of the most appalling level crossing accidents were at lonely cross-roads where the traffic was, and is, very light. To protect these and leave others unprotected would be a mistake.

The municipalities are as much interested as the railways, and they should at once prepare plans, gather statistics, and submit suggestions to the Board, that the interests of the users of the highways may be just as carefully considered as the comfort and safety of railway travellers.

In this connection it is interesting to note that the Railway Commission have ordered gates at Raglan Street crossing at Renfrew, Ont. Twenty per cent. of the cost of erecting the gates will be paid out of the

Federal fund; the balance must be paid by the C.P.R. The watchman is to be paid half by the company and half by the town.

RAILWAY CREATED WEALTH.

Next month the Grand Trunk Pacific Railway will be carrying passengers from Winnipeg to Edmonton, and the autumn will see wheat from Edmonton carried by G.T.P. to Port Arthur.

A new country has been opened, and all along the line land values have increased three, four and fivefold because of the improved transportation route. The wild prairie has become cultivated farms. The small station site has grown into a town, and the uninhabited northland has been filled with settlers.

We have spent thousands of dollars and years of time advertising Northern Canada, but the railway comes and fills the country, adds wealth to the nation, and moves the wild prairie lines a couple or three hundred miles north.

The railway builders are our constructive statesmen. At times we think they come high, but their politics are of the practical sort, and we must recognize that without transportation there would be no land values, and if in their work of railway building they have amassed private fortunes let us recognize that they have made possible the immensely vaster wealth of the settler, whose product they carry to the market.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.

Toronto is a convention city, and as a municipality they spend thousands of dollars annually entertaining delegations, deputations, and conventions from all over Canada, the United States, and even Europe. One would think, then, that when their own citizens unite to present an exhibition and hold a convention, which was not a cemmercial venture, the City Council would welcome and encourage the idea.

But, no; the Council assess them about twelve hundred dollars for the privilege of using the Market building.

The City Council could well afford to make a rebate to the Association and encourage this young organization in improving the methods of handling, educational and experimental work with concrete, the most adaptable of modern building materials.

THE INTERCOLONIAL DEFICIT.

Great noise is being made in the press about the profits the Intercolonial Railway Commission are able to show.

We have heard all about retrenchment, wiping out of deficits, and profits on the Intercolonial before. Each new Minister of Railways commences with such an announcement.

We have no doubt but that the Commission will do great things for and by the Intercolonial, but to estimate results on two months' returns is a doubtful undertaking.

NOTE THE TIME, THE PLACE, AND THE WORK.

July 22nd, 1909. Hannon, Ont. The first tower for the Hydro-Electric power line was erected.

The Hydro-Electric power line has at last been commenced!!!

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.

Arrangements are now being made for the 1909 annual convention of the Canadian Independent Telephone Association, which will be held in Toronto on Wednesday, September 8th, during the second week of the Exhibition.

Among the subjects to be discussed will probably be the following:—Is the Telephone a Natural Monopoly? by F. Dagger; Good Construction; Proper Rates for Rural Service; Collection; Independent Telephones in Railway Stations, by C. Skinner and others; Exchange Directories, by Dr. W. Doan; Reasonable Toll Connection Relations; Good Operating; Independent Telephone Situation in Canada, by Dr. Demers, Dr. Doan, F. Dagger, and others; Forced Physical Connection.

Members are invited to send to the secretary, F. Page Wilson, 226-227 Confederation Life Building, Toronto, any suggestions for other topics to be discussed. Also questions on practical telephone subjects.

OBITUARY.

Mr. Frank Sigsworth Simpson, for many years [illegible] known civil engineer in Toronto, died at his ho[illegible] Spadina Avenue, Toronto, July 26th, 1909.

Mr. Simpson was born in Ottawa fifty-seven years ago, and received his education there. He came to Toronto twenty-one years ago, and has resided here since. His ability as a constructive engineer with the old Great Western Railway brought him to the notice of the city authorities, and he was given charge of a great deal of work in the harbor and along the water front. He carried out the work of laying the last iron water conduit across to the Island. He was also at the head of the dredging work at Coatsworth's Cut, and of a large amount of the dredging in Ashbridge's Bay. He also took charge of the harbor improvement of Hamilton and several of the Lake Ontario ports.

The late Mr. Simpson was a member of the Canadian Society of Civil Engineers and the Engineers' Club, Toronto, and for several years was a member of the Executive Committee of the Toronto Branch of the Canadian Society of Civil Engineers.

ORDER OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee.

7519 and 7520—July 9—Authorizing Manitoba Government Telephones to erect wires across tracks of C.P.R. 150 yards north of Emerson, Man., and at crossing one mile west of Carroll, Man.

7521 to 7524—July 12—Authorizing the Bell Telephone Co. to erect wires across tracks of G.T.R. at Millbrook, Ont.; public crossing 1½ miles south-east Kingscourt, Ont.; public crossing 200 yards south-east of Lynn Valley, Ont., and public crossing four miles south of Midland Station, Ont.

7525—July 17—Recommending to Governor-in-Council for sanction by-law of Ottawa and New York Railway Co. with respect to spitting in cars and on premises of railway.

7526—July 12—Authorizing the Bell Telephone Co. to erect wires across tracks of G.T.R. at public crossing 2½ miles north of Newmarket Station, Ont.

7527—July 13—Authorizing the City of Toronto to lay and maintain a water pipe under tracks of G.T.R. at Front Street East, Toronto.

7528—July 13—Authorizing the Bell Telephone Company to carry its wires across tracks of the C.P.R., one mile south of Waterloo Station, Quebec.

(Continued on Page 120.)

COMPARATIVE WAGES PAID BY MUNICIPALITIES AND PRIVATE PARTIES.

The city of Boston has employed common labor for many years, and has at frequent intervals increased the rate per hour paid for such service. The result of these increases is shown in the accompanying table from the report of Metcalf & Eddy, consulting civil engineers to the Boston Finance Commission:—

Nominal Time Worked and Wages Paid.

Period.	Hours per week.	Nominal rate of wages. Per day.	Per hour.
1878-1883	60	$1 75	$0 17½
1883-1891	60	2 00	20
1891-1897	54	2 00	22½
1897-1900	50	2 00	24
1900-1907	44	2 00	27¼
1907 to date	44	2 25	30¾

From this table it appears that the nominal rate of pay per day for common labor has increased from $1.75 in 1878 to $2.25 at the present time; while during the same period the nominal length of day has been reduced from ten hours to eight hours. The present rate of pay per day, based upon an eight-hour day (28.1 cents per hour) does not indicate the actual net cost to the city of labor. In 1891 the city granted its labor force Saturday half holidays with pay, which custom has prevailed up to the present time. Making allowance for the Saturday half holiday, the rate of pay per hour at the present time becomes 30¾ cents.

It has been customary to allow full pay for legal holidays, and in numerous cases pay has been continued when employees are away on account of sickness. A consideration of all allowances show them to amount to 10.86 per cent. of the total 313 possible working days of the year. Calculating the rate of pay on this basis, the consulting engineers show that instead of a nominal wage of $2.25, the city is paying $2.52 per day, or 31½ cents per hour. The following table shows the rates of wages paid to common laborers by various contractors, and in most cases the length of the working day:—

Length of Day and Rate of Wages of Common Laborers Employed by Local Contractors, 1907 and 1908.

Contractor.	Number of laborers (approximate).	Length of working day (hours).	Rate of pay per hour (cents).
1			25
2			25
3	75	8	22
4	40 to 50	9 to 8[2]	17½ to 20[1]
5	50	10 to 9	20
6			20[1]
7		9	22 2-9[1]
8	12	9 to 8	22 2-9 to 25
9	10	9 to 8	25 to 30
10		8	20 to 25[1]
11			20 to 25
12	200	10[3]	20
13	15 to 20	9 to 8	22 2-9 to 30[4]
14	60 to 70	10 to 9	17½ to 19.4
15	100	9	19.4
16		10	15 to 16
17		10	16
18			$1.75 to $2.00[7]
19	40 to 45	8	22
20	20 to 150	9 to 8	20 to 28
21	75	9	19.4
22		8	25
23	6 to 50	10 to 8	25
24	91	8	20 to 25
25		8	30
26	25		30[4]
27		9	25
28			30[5]
29	25	8	30[6]
30		8	30
31	20	8	30[6]
32		8	30[6]
33	25 to 75	9	19.4
34	25	9	19.4
35	100	9 to 8	20 to 25
36	50 to 500	8	22½

[1] Italian labor.
[2] When nine hours from choice of men.
[3] Unless prohibited in contract.
[4] Others than Italian.
[5] Union labor only.
[6] Same labor as employed for hod carriers.
[7] Per day.

In the case of 32 cities in or near New England, inquiry showed the length of day in the Sewer Department to be 8 hours in twenty-two cases, 8½ hours in two cases, and 9 hours in the balance. The nominal rate of pay ranged from 17 cents per hour to 28⅛ cents per hour, and the actual rate from 17.2 cents per hour to 28.7 cents per hour. Varying conditions were found with regard to pay for holidays and allowances for sick leave. In about one-third of the cities the laborers are permitted to have half-holidays on Saturday, although in about one-half of these cases the half holidays are restricted to the summer months. In several of the cities where half-holidays are granted the length of day is so arranged that the laborers work 48 hours during the week. From this study it appears that the rate of pay of laborers in the city of Boston is at least 32 cents per hour actually worked, while that of laborers employed by local contractors and corporations does not appear to exceed 30 cents per hour, and that the prevailing customary rate is at most 25 cents per hour, practically the same as that paid by other cities throughout New England.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The twentieth annual meeting of the Canadian Association of Stationary Engineers opened at London, Ont., July 27th, with a large attendance of engineers from all parts of the Dominion. The report of Secretary Crockett of Hamilton, presented at this afternoon's session, contains the following important recommendations:

(1) The advisability of getting the Government to grant or endorse a graded certificate, this to be optional with the engineer.

(2) The advisability of making an allowance for the executive President to visit localities where his efforts can be used to organize new lodges.

(3) To make an allowance for visiting every lodge at least once a year.

(4) The advisability of adopting or endorsing a resolution adopted by the London Board of Trade re boiler inspection.

(5) The adoption of a set of questions to be used by all subordinate lodges for the examination of candidates. In the report Mr. Crockett said:

"It is being more fully realized to-day than ever before the duty which devolves upon every engineer in the Dominion, also the urgent necessity for all to aid and assist to their fullest extent, in getting laws enacted which will tend to raise themselves to a higher plane in the engineering profession."

During the year three new lodges, Belleville, North Bay and Brampton, have been added. In speaking of the recommendation regarding the graded certificate, Secretary Crockett said it was one of the most important that have been proposed. "The idea," he said, "is not to make the certificate compulsory, but to give every engineer who desires it a chance to show his employer exactly how much he has learned and as he progresses his employer can keep track of it."

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

TYPHOID AND DRAINAGE.

We publish an article by Mr. Hilder Daw, of Montreal, on the subject of typhoid epidemics. The writer again reiterates his contention, previously recorded in the "Sanitary Review," that much typhoid is the result of unsanitary drainage. By unsanitary drainage special stress is laid upon sewers in which the hydraulic depth of flow fluctuates, causing alternate conditions of wet and dry pipe surface. The typhoid germs are held to be susceptible to dissemination by means of sewer air. Quoting the article: "Now there is always an up-draft in our sewers whereby sporing pathogenic and non-pathogenic germs are wafted to the outer air. It is permissible to imagine that the B. Typhosus, which is of a sticky character, can attach itself to the floating spores." Sewer flushing is pronounced the panacea or remedy for the above condition.

That sufficient attention is not paid to sewer flushing is unquestionable. This especially applies where the combined system of sewerage is in vogue. Where self-cleansing gradients cannot be obtained in sewers, they should be artificially assisted by automatic flushing. Unsanitary sewerage systems are probably more dangerous to public health than the old-fashioned method of no sewers, by which slop water was simply emptied direct into the roadway or street.

In the former we have ideal conditions for the propagation of disease infection. Filth is collected out of sight, and consequently out of mind. An underground sewer, which is incapable of carrying off solids in dry weather, presents an even, warm temperature charged with moisture, excluded from sunlight and fresh air.

By the latter primitive method sewage was exposed to the two most powerful of natural disinfectants, viz., fresh air and sunlight. Any nuisance made itself apparent, and was kept within certain limits.

A sewerage system is without doubt the most important factor in a city's health.

In Canada a sewerage system receives the minimum of attention. We wash our streets, and oil the dust down. We quarantine zymotic diseases, and fix a sentinel on the steps of the infected house; but the sewerage system being out of sight, takes the place of the space under the mat provided for the careless housemaid into which she can hide the dust, and so save the trouble of removal. That sewers internally should present a maximum of cleanliness, and a mimimum production of foul gases, receives little or no attention. That which is a matter of conscious satisfaction, and cannot be paraded in the open, is liable to neglect.

Enteric, or typhoid fever, as it is generally called, is one of the most difficult of zymotic diseases to contend with. There are various channels by which it can be conveyed to the human system. One thing, however, appears certain, and that is that the germs must be absorbed into the food system in order to give rise to the disease. It is primarily an intestinal affection, and the general fever and sickness appear to be due to poisons absorbed by the blood system. These poisons are ptomaine in character, and are the by-products of the bacterial life in the intestinal canal. The infectious media of typhoid is given off with the excrement from the patients, and may be so given off for several years after the patient has quite recovered from the effects of the disease. This latter fact is of great importance, bearing as it does upon the necessity for rapid and thorough removal of sewage, without any chance of food contamination.

Typhoid generally makes its appearance in the autumn season; that is, at that time of the year when there is generally the least amount of rainfall, and consequent sewer flushing, and also when there is a greater amount of vegetable decay in our midst. Epidemics are often carried well into the winter, on account of general carelessness in isolation and protection of food supply. Numerous epidemics have been traced directly to contaminated water and milk. Washing milk utensils with fouled water is the more general cause of an outbreak.

It is impossible, however, to name any one generative source of typhoid outbreaks. The disease is endemic; that is, the infection is constantly with us, and may become epidemic at any time, if the required favorable conditions are provided for its propagation. Favorable conditions must be summed up by the term, **general unhygienic.** Flies are suspected of being one of the chief carriers of infection. The eggs are incubated in filth collections. There the larvæ obtain their sustenance. The fly proceeds direct from filth to the food pantry, plants its excreta emanations on butter and meat. The removal of decaying vegetable matter and stagnant water means the removal of flies. So much of the preventive measures are, however, impracticable, after we have done our individual all, there remain general conditions with which it is difficult to deal. The excuse that we cannot obtain the ideal is no excuse, however, for leaving undone that which can be satisfactorily accomplished.

There is no excuse whatever for the abominable conditions which exist in such sewerage systems as those of Montreal, Winnipeg and many of our large cities, which, instead of serving as means for the rapid removal of filth, are simply filth collectors.

TYPHOID EPIDEMICS.

By Hilder Daw, A.M.C.S.C.E., M.L.E.S., M.C.M.I., A.I.N.A., etc.

From time to time, so-called "epidemics" of typhoid devastate residential (isolated and crowded) and business locations. Much disputation as to the proper remedial measures ensue in the various council chambers. Doctors are divided into warring factions that through failure to agree to differ, combine in failure.

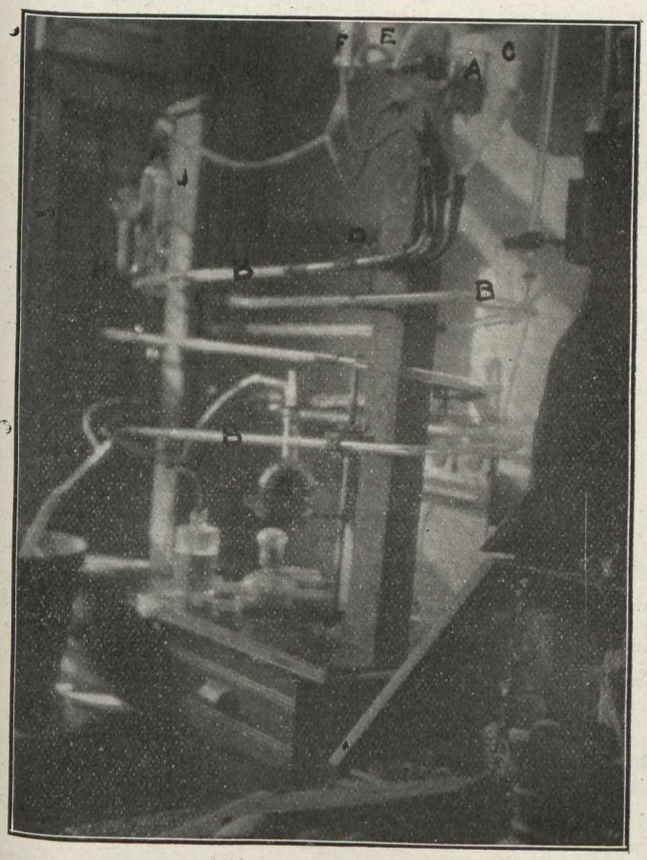
The question has been thrust upon my unwilling attention by reason of its laying me up in hospital. I then had enforced liberty to review past history and formulate the basis of this article.

The history of European cities makes illuminative many points of obscurity, and it is doubtful if many of our municipal authorities' sanitary experts and medical officers of health have given the close attention to latter-day history that is necessary if one attempts to trace the cause of a

baffling "epidemic," the Black Death of early Norman times; the Plague, of the Stuart Dynasty; and the Black Plague of Russia; to say nothing of many continental diseases, are probably derived from the same causes that produce typhus. Roughly speaking, typhus is derivable from stagnant sewage, and it is difficult for us to realize the actual conditions surrounding habitations during the Georgian period.

By studying the drawings of Hogarth, it is borne in upon the mind that all slops and excretae were disposed of by the simple but disconcerting practice of merely "chucking" the contents of night-soil receptacles out of the window. This conclusion is confirmed by reading the humourous plays of the time, and the immortal works of Sir Walter Scott contain many instances of brawls and duels resulting from demands made upon passers-by to "give the wall." This expression takes on a grave significance when it is realized that the wayfarer was liable to be covered with filth at any moment.

Archiologists are given to tracing the establishment of centres of civilization and commerce as primarily due to the presence of a navigable river. We see for ourselves that inter-communication between Montreal and Quebec was



chiefly dependable upon the mighty St. Lawrence, and we see how "portages" retard the development of up-stream townsites. Therefore we can follow their arguments and agree with those conclusions.

But we do not recall of any thesis that claimed that the **hamlets or towns which were blessed with a running stream of water in the roadway or "kennel" were the healthiest.** It is, however, inferable, and I would go further, and claim that those with a heavy annual rain-fall would be healthier than those towns which were dependable upon jackals and carrion crows. Men of a mountainous district were hardier than those of a long lying plain, not only because of the entailed exercise and rarified air, but also because their sanitary conditions were naturally more favorable. History records the deeds of Huns, Goths, Picts and Scots, Norsemen and men of Northern breed. They devastated the Southern plains, took possession, and retrograded to extinction. The same process is now in operation. For many years I have made enquiries, but I have **never met a Londoner of the third generation.**

Canadians woud be surprised if they knew the value put upon vultures, carrion birds and jackals in Eastern and African climes. In West Africa it is an indictable offence to kill one of these "sanitary inspectors." The "Potter's Field" of Biblical times, could not have been the receptacle of the indigent dead for so long a period had not the dead been devoured. Pestilence, with attendant famine, must have followed the natural decomposition of dead bodies in the open air.

Old Quebecers are stored with reminiscences about the unsanitary conditions of the Old Town. They quote with pride the fact that their drinking water was taken out of the river from amongst dead bodies and back-water filth. They say there was "body" in their drinking water in those days. We can merely admit that their uvulas, tonsils, and bodily health were exceptionally robust.

Looking backward, we say, "How very ignorant our rude forefathers were in those days. Why, they actually had no sewers."

Looking forward, we can anticipate our descendants saying, "How very ignorant our rude forefathers were in those days. They had sewers, but did not flush them. They studied ancient history and dead languages, but ignored latter-day history and living languages. They knew the water they drank to be full of animalculae, yet would not "ozone" the water. They knew they were poisoning the rivers with their sewage, but as there was no returning current, it mattered not. They spat upon their earthen roads, and the automobiles churned up the dust. Their breath of life was charged with death, yet apathy prevailed."

Typus, and the pleasures of childhood, are of the past. Typhoid, taxation and the poor are with us yet.

Typhoid is connected with "running sewage," in contradistinction to typhus, and vitally affects the water and milk supplies. Without dealing with the water and milk questions, or with the purification of sewage in this article, I propose to discuss that which, in England, is a minor cause of typhoidal outbreaks; but which in Canada assumes the predominant factor. I allude to the absence of proper provision for automatically flushing the main sewers.

Since taking up this question, I have had many communcations from England, and it is curious to read how the sanitary authorities there cannot believe that we have ignored this matter.

At our homes, before and after business hours, the sewage in the sewers attains the abnormal levels. During business hours, it sinks to the normal, leaving the sides encrusted with filth containing disease germs.

Now there is always an up-draft in our sewers whereby the sporing pathogenic and non-pathogenic germs are wafted to the outer air. It is permissible to imagine that the B. Typhosus, which is of a sticky character, can attach itself to the floating spores. Whatever be the means, it is now indisputable that B. Typhosus gains access to houses through faulty or un-trapped drains, and through dangerous road-ventilators. It is through ignoring this point that American cities are not able to eradicate typhoid from their midst, and that, notwithstanding, that the purification of sewage, water and milk has been effected.

The sewers are favorable to the growth of the B. Typhosus, the damp humidity therein being an ideal condition. Therefore it follows that the sewers should be cleansed, not with a cursory dribble from a 3-inch hose stand, but with a short bulky body of water that will descend the sewer like a piston head. Naturally, in the course of its progress, this body looses its efficiency; and its power must then be reinforced by a supplementary discharge from another tank placed at suitable strategical site.

About 20 years ago, the authorities of St. Bartholemew's Hospital were perplexed by the unsanitary condition of their hospital. Examination proved that the sewers were too large to be flushed properly; the intrados was encrusted with ancient filth. A smaller sewer system was installed with perfect success.

To the writer's knowledge, a virulent outbreak of typhoid was effectually checked by the installation of these flushing tanks by order of the Local Government Board in England.

It is not a theory, it is empiric. Yet opposition is offered on the ground that sewers are not strong enough, that low lying basements might be flooded, that the frosts of Canada are too severe, and that the tanks of water might be frozen.

In reply to these points I would say that these points are matters that have been overcome satisfactorily, a weak sewer has to be strengthened, although the expansive force is very slight; the low lying basements are gradually eliminated as contrary to by-laws, and the tanks are earth-sealed and frost resisting. The expense of these tanks is very trivial as compared with their importance. They average $150 each, complete, and require no attention after adjustment.

The glass model illustrates the foregoing system. A. A. are little glass tanks that periodically discharge the flushing water into the sewer system B. B. B. The flow of sewage is derived from the tank C, and the normal and abnormal flows are controlled by tap D. The tank's water is supplied from reservoir E. The updraft in the sewer is created by the aspirator F, and bromine fumes are introduced from flask G to indicate passage of sewer gases towards the ventilators and P-trap H. The ventilator shafts are I and J, and the closing of these shafts results in sewer gas getting past P-trap H.

SEWAGE PURIFICATION vs. WATER FILTRATION.*

By George C. Whipple.

Water filtration and sewage purification are not antagonistic, as might be inferred from the title, any more than the hammer and the mallet of the carpenter's chest are antagonistic. Both of these tools are needed, and they are handled by the craftsman in a somewhat similar way, yet each has a particular use. The skilled workman always knows which tool to use; the apprentice and the amateur sometimes use the wrong tool. So it is with the two sanitary measures referred to. Water filtration is an agency for rendering a natural water or a polluted water clean and wholesome; the various methods of sewage purification are primarily agencies for helping to dispose of the faecal and industrial wastes of a community without nuisance. Both are alike in that they seek to remove objectionable or polluting substances from water; but in one case the pollution of the water to be treated is relatively small and can be easily and cheaply removed, while in the other case the polluting matters of sewage are large in amount and can be removed only at considerable expense. So obviously simple is this proposition that it seems strange that municipalities should ever attempt to use the wrong tool. Yet in the protection of public water supplies the attention of the public is sometimes distracted from water filtration by plausible arguments in favor of sewage purification. The attempt is made to use the mallet, when the hammer would be more effective.

Take, for example, the case of a certain city situated on one of our large lakes. Like many other cities similarly situated, it discharged its raw sewage into the lake with little expense and with little or no nuisance to sight or smell; it also took its water supply from the same lake, and the natural consequence was a high death rate from typhoid fever. In the course of time the city awakened to the danger, and the question of filtering the water was agitated. All the official sanitary advisers and most of the citizens favored this; but others said "No; let us purify the sewage and the wholesomeness of the water will follow as a matter of course." This idea may have had its animus partly in political circles, but it was a plausible suggestion and was accepted by many. Water filtration ultimately triumphed, but its introduction was retarded by a discussion based on false premises.

Again, take the case of a large river with many communities along its shores, some using the waters of the stream for drinking purposes, and all, perhaps, using it as a place of depositing sewage. Suppose that all these communities had sewage purification plants of the ordinary type which discharged their effluents into the river, would the water supplies of the down-stream communities be safe? By no means. Ordinary sewage purification plants do not turn out drinking water, while the mere presence of a large community upon the shores of a stream, with all the necessarily involved opportunities for occasional or accidental contamination, is in itself a menace to a water supply taken from the stream below it.

In order adequately to safeguard the purity of public water supplies taken from rivers and lakes in populous regions there is only one course to pursue, and that is to filter the water. If the water is but slightly polluted filtration is sufficient; if the pollution is considerable, chemical treatment or double filtration should be used or the pollution should be reduced by means of proper sewage disposal plants. There are some cases now, and as the country grows these will become more numerous, where both sewage purification works and filter plants are necessary, but under most conditions water filtration logically should be put first, for it costs less and is more efficient. Of course, this statement, like all general statements, is not without exception, and some cases undoubtedly exist, as the speaker well knows, where to thoroughly purify a very small amount of sewage that is endangering a large water supply is cheaper than to filter the entire water supply.

Some may think that there is no occasion for calling attention to this question of the relative importance of water filtration, and sewage purification, but a study of the articles that are appearing in the popular magazines and papers of the day indicates that so far as the protection of water supplies is concerned there is a tendency to place the emphasis in the wrong place. In some States, as in New York, the State Department of Health has authority to compel a city or town to install sewage purification works, but has no authority to compel the filtration of water. Plans for sewer systems have to be examined and approved by the health department, but plans for waterworks systems do not have to be so approved. This condition is scientifically illogical and deserves correction.

The speaker has never forgotten the remark made to him a few years ago by a distinguished German sanitarian who was visiting this country for the purpose of studying the admirable sanitary work of the Massachusetts State Board of Health. He said, "It is all very fine, but very funny. You purify your sewage, but you drink your water raw." It was contrary to sanitary science, as he knew it.

What has brought about this condition? It is partly due to the natural feeling that is expressed in the saying that "innocence is better than repentance," and that "pure water is better than purified water." Taken literally, no one can question the soundness of this principle. The difficulty is where to find the water supply that is naturally pure, or that is not liable to pollution.

It is due partly to a natural feeling of repugnance at the idea of allowing the waters of streams to be contaminated and then spending money to purify them. To this it may be said that it is only a question of time and place when and where the contamination is removed; in one case the faecal matter is largely, but not wholly, removed from the sewer water before it reaches the river, while in the other case it is removed from the river water more effectively at a point nearer the consumer. The essential thing is that some purifying mechanism stand between the source of pollution and the water tap, and it is not a question of where this is, but how efficient it is.

Sewage disposal is attracting public attention for another reason. There have been recently some remarkable improvements in methods of sewage purification. These took their origin in England, from whence they have spread to other countries and to America. Unquestionably, these methods are interesting and deserve attention, but it ought not to be forgotten that they took their rise in a country where the water supplies are almost universally filtered. Water filtration in England was an old story a generation ago. England,

*Paper read before the American Society of Municipal Improvements at Atlantic City, N.J., on October 21st.

because of her dense population, has advanced to the second stage where she demands both sewage purification and water filtration. America ought not to take the second step before the first. She will not do so if she follows the advice of her trained sanitarians instead of the amateurs who seize upon the striking topics of the hour and do not consider the subject in a broad, conservative way.

As an illustration of the effect of popular sanitary writings, an instance may be mentioned that once came to the speaker's notice.

A wealthy man, owning a large estate, went to an expert for advice as to the question of sewage disposal. He had been reading the "House Beautiful," or something like that, and had learned that sewage must be treated by two processes, one the **aerobic,** and the other the **anaerobic.** He could pronounce these words glibly, and knew what they meant. He also knew that a septic tank and a contact bed would give the two processes an opportunity to work; and being a man of action as well as thought, he had constructed such a plant near his house. The result was that the family had to move out for a time until the caretaker, a common-sense farmer, who did not understand the difference between a septic tank and a cesspool, succeeded in conveying the tank effluent into some tile drains hastily laid. This change resulted in an entire elimination of the nuisance, as there was an unlimited acreage available. Yet the enthusiastic reader of the "House Beautiful" still felt so much anxiety because the sewage was not being purified **aerobically** and **anaerobically** that he was willing to pay for expert advice in order to see how these desirable processes could be secured. He was told that his farmer was entitled to the fee as he had already solved the problem.

But deeper than all this is the popular demand for decency. The watchword of the day is **cleanliness.** Cleaner houses, cleaner streets, cleaner food, cleaner politics, and cleaner lives are things that the world is striving for. Since the day when the bacteriologist proved that dirt is dangerous, there has been a wonderful response to the sanitarian's call for cleanliness, and it has had wonderful results, as the vital statistics show. It is not surprising, therefore, that cleanliness for the sake of health should be followed by cleanliness for its own sake. With this demand for decency the speaker is in hearty sympathy. But the science of sanitation is a new science, and it is easy for false theories to take root and for sound theories to become overworked. Amid the brilliant researches that are being made there is needed the saving grace of common-sense.

This country is growing rapidly, and the cities are growing faster than the rural districts. Manufacturing is increasing, and the factories are naturally locating along the watercourses. The waters of our rivers are, therefore, becoming foul to an increasing extent, doing great damage, and in some cases irretrievable injury. This is a serious matter; for if, by increasing our capital in the form of factories and mills, we decrease it in the form of natural resources, then we are not as a nation growing rich as rapidly as we think. Already some streams in America are as greatly polluted as many in England, as, for instance, the Passaic River in New Jersey, about which so much is just now being said.

To restore these polluted streams to their pristine purity will be impracticable, if not impossible; but they can be prevented from becoming a nuisance to sight and smell, and a menace to health by a rigorous policy of exclusion or purification of sewage and trade wastes, and the speaker believes that this ought to be done before, rather than after, the streams have become overcharged with pollution.

During the past few weeks a notable event has occurred in England. The Royal Commission on Sewage Disposal, after several years' study of the whole matter, has submitted its report and formulated its findings, placing its official approval on some of the modern methods of purification and cautioning against some of their weaknesses. As a sane, common-sense document this report is worthy of great commendation, and its influence ought to be widespread in the sanitary world. Much criticised in the past for not immediately accepting each new theory as soon as propounded, the scientific conservatism of this commission will give its report added weight in years to come.

One thing is conspicuous throughout this report of the Royal Commission—viz., that the whole question of sewage disposal is treated from the standpoint of nuisance. It is recognized that disposal works are to be operated to avoid offensive conditions, not to protect water supplies. The degree of purification is to be adjusted to the stream into which the effluent is discharged. Disposal by dilution is tacitly recognized as a sensible and legitimate form of treatment. Nature's methods of purification are to be availed of so far as they are capable of acting.

To quote from the report:—"We are satisfied that rivers generally, those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pullutions besides sewage, and it appears to us, therefore, that any authority taking water from such rivers for the purpose of water supply must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority, systematically and thoroughly, to purify the water before distributing it to their customers.

"Apart from the question of drinking waters, we find no evidence to show that the mere presence of organisms of a noxious character in a river constitutes a danger to public health or destroys the amenities of the river. Generally speaking, therefore, we do not consider that in the present state of knowledge we should be justified in recommending that it should be the duty of a local authority to treat its sewage so that it should be bacteriologically pure."

The speaker believes that this is as it should be. Sewage purification plants should be built where they are needed to prevent nuisance; where the streams are small and the volume of sewage great their efficiency should be high; where the danger of nuisance is slight the efficiency of the plant need not be high; where the dilution is sufficient no other process than screening need be used. But septic tanks, sprinkling filters and contact beds should not be depended upon to protect water supplies, functions for which they are naturally not fitted. The influences that bring about the self-purification of streams may be utilized to mitigate the nuisances of sewage pollution, but are not to be depended upon to protect water supplies to be used for drinking.

In this discussion one point has not been mentioned, and that is the responsibility that one community owes to another. Is it right that an up-stream community, by polluting a river, should put a down-stream community to the expense of filtering its water supply? On the other hand, has the down-stream community a right to insist that the up-stream community shall change its sewage into drinking water? These are very important questions, involving various common law rights, which our jurists should lose no time in making clear. That there are conflicting interests no one can deny. There are many equities that will have to be adjusted, and these will vary under different conditions, but if the principle is recognized that filtration plants are best adapted to protect water supply, and that sewage purification plants are best adapted to prevent general nuisances, it will be found easier to adjust these equities; and if our State Departments of Health and our sanitary laws can be made to conform to this principle there will be a great saving of expense and a more rapid improvement in the public health.

WINNIPEG.—The city solicitor has been instructed to prepare a by-law granting a franchise to W. E. Skinner for a steam heating and distributing plant. According to the proposed by-law the concern will pay nothing for the franchise for the first three years, but will pay 2½ per cent. on the gross receipts after that time. A bond of $125,000 will be put up guaranteeing the city against damage to the streets in the installation of the plant.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of July 21		STOCK QUOTATIONS TORONTO				STOCK QUOTATIONS MONTREAL			
				1909	1908	Price July 23 '08	Price July 15 '09	Price July 22 '09	Sales Week End'd July22	Price July 23 '08	Price July 15 '09	Price July 22 '09	Sales Week End'd July22
Canadian Pacific Railway	8,920.6	$150,000	$100	1,502,000	1,400,000	169¾ 168½	186 184½	185½	523	169½ 169	185 184⅝	186¼ 185¼	3090
Canadian Northern Railway	2,986.9	.....	.....	211,800	170,900	.....	.....	.....	.....	.....	.....	.....	.....
*Grand Trunk Railway	3,536	226,000	100	765,672	729,702	.....	... *1st. pref. 105½, 3rd pref. 56⅜, ordinary 23⅜			.....	.....	.....	.....
T. & N. O.	334	(Gov. Road)	.....	31,345	17,321	.....	.....	.....	.....	.....	.....	.....	.....
Montreal Street Railway	138.3	18,000	100	71,622	75,260	.....	.....	.....	.....	175 173	216 215¾	217 216½	967
Toronto Street Railway	114	8,000	100	67,682	65,039	98¾	125	.....	115	99 98⅝	124 123¾	126⅜ 126¼	2059
Winnipeg Electric	70	6,000	100	.....	.....	158 157	187½	.....	.....	158¾ 157¼	.....	185½	.....

* G.T.R. Stock is not listed on Canadian Exchanges These prices are quoted on the London Stock Exchange.

COMPARISON OF CANADIAN RAILWAYS.

The following comparative table, showing the cost per mile of operating the principal Canadian railways and the percentage of expenditue to income is published by the Temiskaming & Northern Ontario Commissions. The Government Railway in this comparison makes a very creditable showing. The statement showing the earnings and expenses per mile and the operating ratio per cent. for 1908:—

Road	Average No. of miles of road operated	Earnings per mile of road	Expenses per mile of road	Net Earnings per mile	Oper. ratio per cent.
G. T. R.	3,536	$8,554.79	$6,035.44	$2,519.35	70.55
C. P. R.	9,426.4	*7,572.79	*5,260.95	2,311 84	69.47
C. N. R.	2,866	3,387.81	2,329.64	1,058.17	68.77
Central Ontario	149.73	1,796.15	1,026.18	769.97	57
Kingston & Pembroke	109.8	1,980.17	1,587.99	392.18	80
Bay of Quinte Railway	108.375	2,157.53	1,483.63	673.90	68.8
Thousand Islands Railway	6.33	5,382.88	4,572.06	810.82	84.9
Quebec Central	222	5,003.26	3,546.36	1,456.90	70.88
Algoma Central & H.B. Railway	80	4,500.03	3,164.35	1,344.70	70.17
T. H. & B.	83.67	9,739.33	7,973.43	1,765.90	78.13
Temiscouata Railway	113	1,865.30	1,353.29	512.01	72.55
T. & N. O. Railway	191	5,094.59	3,604.17	1,490.42	70.8

JUNE RAILWAY EARNINGS.

C.P.R. in Second Place.

For some time past C.P.R. has been leading the roads of America in point of gross increase, but in June had to take second place to Hill's Great Northern. The main increases were as follows:—

Great Northern	$980,571
Canadian Pacific	896,006
Baltimore and Ohio	775,830
Chesapeake and Ohio	449,219
Missouri Pacific	423,000
Denver and Rio Grande	271,100
Buffalo, Rochester and Pitts	205,503
Illinois Central	192,549
Minneapolis, St. Paul & S. S. M.	158,613
Wabash	152,104
Southern	149,213
Texas and Pacific	144,053
Canadian Northern	130,600
Grand Trunk	85,103
Louis. and Nash.	84,653

Taking up the individual increases, it is found that while Great Northern reports a gain of $980,571, that does not overcome the loss of $1554,304 which was scored in June 1908. The second large increase—that of Canadian Pacific, $896,000—contrasts with a drop of $1,359,712 in June of last year.

FREIGHT ROUTE TO WEST.

By a traffic arrangement which goes into effect August 5th the Canadian Northern Railway Company will be able to route freight from Toronto or any point on its Ontario system to the West by using the C.P.R. from Sudbury westward to Port Arthur. A similar arrangement the G.T.R. has enjoyed ever since the C.P.R. opened its western lines, so the G.T.R. and C.N.R. are now on a similar competitive basis, as far as trade routes to the West are concerned.

The C.P.R. will take up the freight where the C.N.R. drops it at its present terminus, Sudbury.

Mr. D. McNicoll, general manager, C.P.R., says he has not heard of such an arrangement.

*C.P.R. includes parlor and sleeping car revenue and expense.

UNITED STATES RAILWAYS.

The railway line of trade in the United States is showing further advancement. Forty-three roads for the second week in July show an average gross increase of 3.85 per cent.

MACKENZIE & MANN ROAD FOR YEAR.

Mackenzie & Mann's Canadian Northern for the year ending June 30th showed net earnings of $2,795,400, an increase over 1908 of $311,400. The comparative figures for the year follow:—

	1909.	1908.	Increase.
Gross earnings	$9,668,900	$9,012,400	$656,500
Expenses	6,873,500	6,528,400	345,100
Net earnings	2,795,400	2,484,000	311,400
Mileage in operation	*3,013	*2,866	147

(Continued from Page 114.)

7529—July 10—Rescinding Order No. 7298, dated June 19th, 1909, which dismissed application of the C.P.R. for Order directing the G.T.R. to receive the passenger and baggage cars of the C.P.R. at the point of junction between the two railways near Sappers' Bridge, Ottawa; the application to be set down for hearing at the sittings of the Board at Ottawa, September 1909, unless before that time the matter has been settled between the companies.

7530—July 15—Authorizing the C.P.R to construct one bridge at Laggan Section and three bridges at Red Deer Section, Western Division.

7531—July 16—Authorizing the C.P.R. to construct a branch line to the premises of the Imperial Oil Company, Delorimier, Quebec.

(Continued on Page 136.)

* Average.

INTERLOCKING AND SIGNALLING.

E. W. OLIVER, B.A.Sc., C.E. (TOR.),
Canadian Northern Railway System.

It is not the purpose of this paper to go into a detailed analysis of the subject of signalling, as such would require much more space than is available under the existing conditions. It would require volumes to discuss in detail that subject from its inception, early in the last century, down to the present day, with its various forms, as used by the principal railways of Europe and America, and even beyond in countries where a few years ago railroads did not exist.

It has been deemed more advisable to set forth with some detail the conditions of interlocking and signalling required at grade crossings of railways in this country. These conditions have been largely moulded by the various regulations issued by the Board of Railway Commissioners of Canada. This Board was constituted by the Federal Government in the Railway Act of 1903, with powers to control the detail of railway construction and operation, and to settle all disputes arising therefrom. It will thus be noted that the powers of this Board are exceedingly large and its duties require the continual attention of its five members and the staff of experts in the various departments.

Prior to February, 1904, the date when the Board of Railway Commissioners assumed office, the procedure in the matter of railway crossings was exceedingly vague. It was largely a matter of stealing a crossing and taking the matter of maintenance to the Railway Committee of the Privy Council for settlement. Generally speaking, some agreement was attempted between the companies, with the senior company dictating the terms, and having it afterwards ratified by the Railway Committee. Such arrangement, however, resulted in endless strife in many cases, and little, if any, attempt at the standardizing the interlocking plants erected. These conditions are now greatly improved, and in general, the Board of Railway Commissioners have issued regulations which tend toward the proper basis of crossing agreement and the installation of adequate equipment of interlocking to protect the travelling public and company rights.

It is particularly desired that this paper shall be an attempt to discuss the subject from the conditions as we meet them in Canada at the present time, and reference will be made from time to time to various plants installed within the past two years, in order to give a clear conception of conditions peculiar to local conditions.

Requirements for Crossing Privilege.

Within the past ten years the number of miles of railway in operation in Canada has increased from 16,550 miles to 22,452 miles, or nearly 36 per cent. Such wonderful development has resulted in 81 additional grade crossings, making a total of 315, as well as under and over crossings. In that section of the country lying between the eastern boundary of Manitoba and the Rocky Mountains, under or over crossings are xceptional on account of the flatness of the country. In Ontario and the Eastern Provinces greater opportunity is afforded for grade crossing elimination, although it is not always found to be feasible.

Before construction of a railway is commenced, it is necessary to first fyle with the Minister of Railways a route map, in triplicate (preferably on a scale of six miles per inch) which defines, within one mile on each side, the country proposed to be traversed. A copy of this, certified by the Minister, is then forwarded to the Board of Railway Commissioners, who approve all subsequent plans. The right of way plans and profiles are then submitted to the Board, who approve the location if same is made within the mile limit of the route map. If this location crosses the line of another railway it is necessary to prepare a plan and profile in triplicate showing both lines for a distance of two miles on each side of the crossing.

The Board can then issue an order approving these plans with whatever conditions are made necessary in the particular case. The orders set forth the details of interlocking required, and generally the time allowed for the operation of work trains over the diamond, before the plant is in full working condition, is specified.

In the case of a branch or main line of one railway crossing one another line of the same company, conditions are somewhat different. The Board, within the past month, has ruled that the approval of such a crossing is not necessary, and unless conditions are extraordinary, interlocking plants are not required, providing the operation on both lines is under the control of one despatcher. It is reasonable to suppose, however, that such ruling will be reversed within the near future as such is hardly in accordance with the accepted principle of the Board to safeguard public travel under all conditions.

Principles of Interlocking.

The fundamental idea of interlocking is to eliminate as far as possible the human agency of operating signals at a crossing, and thus produce as near as possible an absolute protection to the travelling public and the property of interested companies.

An interlocking plant consists of a group of levers concentrated at a central point for operating certain switches and

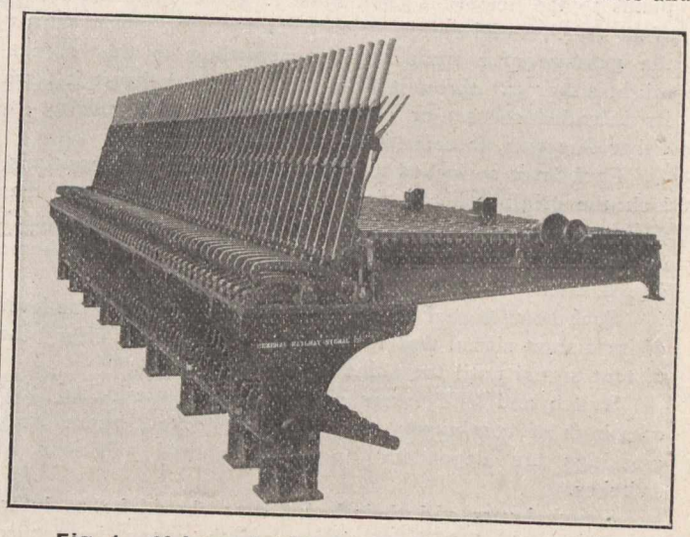


Fig. 1.—60-Lever Interlocker for Beacon Park, Mass.

signals, and so arranged as to interlock such levers and make it impossible to give "clear" signals for conflicting routes. The advantages derived therefrom are safety, facility of operating and saving in cost of manual labor employed.

A description of the original mechanical machine will give not only the method of operation peculiar to itself, but also a general idea of the principle of interlocking as used in all machines. The machine may be small in size, that it, may have but few levers, sufficient to properly protect a single track grade crossing; or it may be to take care of a crossover between the tracks of a double-track road. Or, on the other hand, the machine may be a large one, with many levers, sufficient to handle any combination resulting from several roads crossing one another and provide for necessary transfer tracks; or it may be for handling a large classification yard, a large passenger terminal, or a combination of any of the above. It, therefore, follows, that the size of the machine depends entirely upon the arrangement of the tracks which it is to govern.

A general view of the machine levers is set forth in Fig. 1. The levers, it will be noticed, are provided with latches, which, in the case of the lever locking machines, perform the duty of keeping the lever in the normal of reverse position; but in latch locking machines, the type in general use, it locks and unlocks all other levers. A lever which is to lock certain levers and release certain other levers must complete all its locking functions before the beginning of its stroke, and must not accomplish its releasing or interlocking functions until after its stroke is completed. This principle is the fundamental one in preliminary interlocking.

The spring latch affords the means by which it is possible to meet these conditions; and it is now invariably used to actuate the interlocking mechanism. The result is that

the interlocking mechanism receives an initial movement prior to the stroke of the lever, and receives a final movement after the stroke is completed. These features of interlocking are common to all successful machines, although the machines by which these are accomplished may differ. The spring latch is the small handle set at the side of the handle of the switch of signal lever, and is connected to a lug or stop which drops into a slot in the sector bar of the lever frame when the lever is at either end of this stroke, thus holding the lever in position. The signal-man grasps the lever handle and the spring latch at the same time, but must grip them so as to bring the latter close against the former, and this movement raises the lug or stop, so that the lever can then be moved to the other end of the sector, when by releasing his grasp on the handle the spring latch forces the clasp down into the other notch. It is this movement preliminary to the stroke of the main lever, which is used to actuate the interlocking mechanism, and thus no strain can be put on this mechanism by an attempt to throw the wrong lever, since the lever must be unlocked by its spring latch before it is free to move.

Each home signal, lever, in that position which corresponds to the "clear" signal, must lock the operating levers of all switches and switch locks which by being moved during the passage of a train running according to that signal, might either (a) throw it from the track, (b) divert it from its intended course, or (c) allow another train moving in either direction, to come into collision with it.

Each lever so locked must, in some of its two positions, lock the original home signal in its danger position, that position of lever being taken which gives a position of switch or switch lock contradictory to the route implied by the home signal when "clear."

Each home signal should be so interlocked with the lever of its distant signal that it will be impossible to "clear" the distant signal until the home signal is "cleared."

Switch and lock levers should be so interlocked that crossings of continuous tracks cannot occur, where such crossings are dependent upon the mutual positions of switches.

Switch levers and their lock levers should be so interlocked that the lever operating a switch cannot be moved while that switch is locked.

When it is desired to install an interlocking plant, the first thing is to have a plan of tracks, which is then signalled up, that is, all the switches to be operated are noted, the derails, signals, tower and run of connections are located. In planning the connections, the first principle is to reduce to a minimum the number of cranks between levers and points to overcome lost motion as far as possible. This is essential to an efficient and smooth running plant and should receive the closest attention of the designer.

The size of the machine and functions of each lever are determined, and a diagram of the lead-out made. From the signalling plan, a locking sheet is then made, that is, the proper interlocking to be done between levers is determined, and from this locking sheet a dog sheet is made, which is a diagram showing the arrangements of the interlocking parts as they are placed in the machine.

The plan, as shown in Fig. 2, is a typical lay-out of tracks, showing a single track grade crossing protected by derails, home and distant semaphores. When no movements are being made over the crossings all the derails are open, all semaphores are in the horizontal (danger-stop) position, and when in such position they are known as being normal and the levers in the machine are normal also. When a derail is closed or a semaphore "cleared," they are known to be in the reverse position, and the lever by which the operation is performed is then also known as being in the reverse position.

When a movement is desired over any one of the tracks, it is necessary to set all switches and derails in the right position for such movements, then lock them in such position, after which the signal governing traffic over that particular track may be "cleared."

A "Manipulation" chart should always be framed and hung in the cabin for use of the operator. This chart gives the numbers of the various levers which govern movements in any one direction. The closing of either derail in the route locks all the derials of conflicting routes normal, and they in turn hold the signals normal. Therefore, it will be seen that where two or more routes conflict, the signals of but one can be "cleared."

Diamonds.

The first portion of an interlocking plant ordered for a crossing is the diamond, and it is of some importance that care be exercised in its selection. It is important not only from the standpoint of efficiency in performing the functions of a crossing, but in the matter of future maintenance charges. The annual cost of maintaining grade crossings forms sufficient reason for the expenditure of large sums of money to obtain over or under crossings instead.

When two tracks intersect crossing frogs must be used to give a flangeway in both directions, and as there is no uniformity in the angles the crossings or diamonds have generally to be specially made for each case. They are built up of rails bolted together with filling pieces between and heavy connections in the angles. They should be rivetted to base plates at the corners, or in some cases these plates may extend continuously under the rails. The rail ends may be bevelled off to a miter joint at the frog point, or have one rail butted against the other. The inner wing rail, or guard

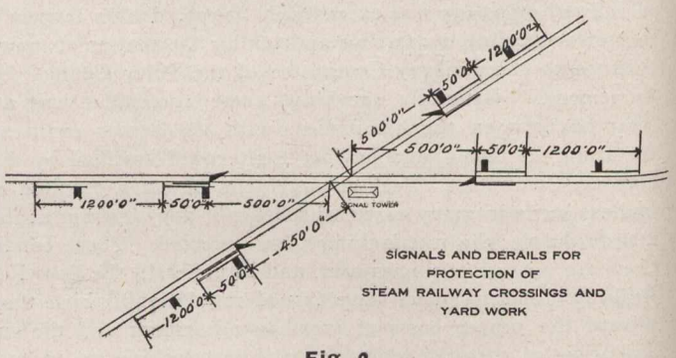


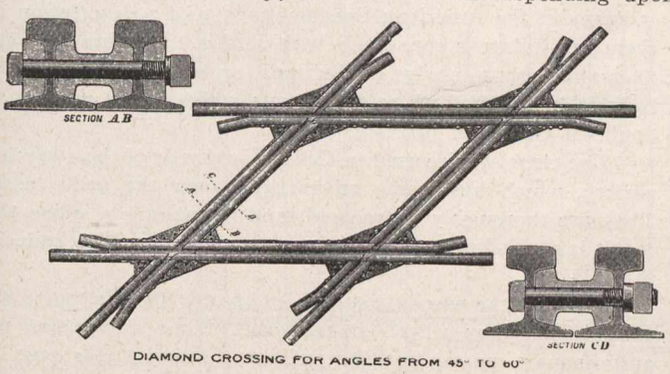
Fig. 2.

rail, is generally continuous in crossings having an angle of 45 to 90 degrees, but is sometimes stopped and flared out at each corner, as in Fig. 3. Where one track is the more important, the rails may be continuous, having the heads grooved to form flangeways for wheels crossing them. At crossings on busy tracks, a third rail is generally placed against the outside of the track rail to carry the false flanges of badly worn wheels and prevent them from battering the rails at the flangeways. The ends of these "easer" rails are inclined, so that wheels will take a bearing on them without shock. Crossings are sometimes built up without a joint between the frogs, but this makes a very heavy section for transportation, and does not admit of repairs without taking up the diamond. As a rule it is better to have a joint in two sides. The sharper the angle of crossing, the greater will be the wear on the frogs, due to the battering effect of the wheels in jumping over the flangeways.

Railway grade crossings are exceedingly hard to keep in proper condition, largely due to the frequent disturbance of the old grade at time of installation of diamond, and also to the unsettled banks of the new line; all of which result in uneven settlement and pounding on the diamond during the passage of a train. It frequently happens that the first diamond lasts but a short time before some portion becomes broken or the points badly battered, and a spare diamond should always be kept on hand to prevent delays to traffic in case of accident.

Within the past few years it has been found to be exceedingly advantageous to use manganese diamonds instead of the ordinary type. The properties of manganese steel are hardness and toughness, and a bar of this metal can be bent through an angle of 180 degrees without showing signs of fracture. Messrs. Haddfields, of Sheffield, England, were the originators of this metal as applied to railway crossings,

and the present excellent product was the result of a great deal of investigation. They commenced with the addition of 2 per cent. manganese, and increased this to 7 per cent., at which point they found the metal very brittle and experiments ceased. Later on, however, they were again taken up, and more by accident than otherwise higher percentages were used, namely, from 10 to 30 per cent. At 10 per cent. the metal began to recover its toughness and held this property until near 20 per cent., when brittleness became apparent again, and further investigation proved the best percentage to be between 10 and 15; the exact amount depending upon



DIAMOND CROSSING FOR ANGLES FROM 45° TO 60°

Fig. 3.

the particular use intended. A manganese diamond is cast in complete sections, and on account of its great hardness the only machine work that can be done on it is grinding. It is quite brittle after removal from the sand, and it acquires its final properties by being heated in a special gas furnace to a very high and exact temperature. That they are improvement on the ordinary type there can be little doubt, as they are more compact with fewer plates and bolts. The wearing capacity of a manganese diamond, **if placed on good foundation,** compared with the ordinary type, is about 5 to 1, and sometimes more. They cost, at present quotations about $550 for angles from 60 degrees to 90 degrees, and compared with the cost of the ordinary type, namely, $350, they are desirable from all points of view. Perhaps the only drawback manganese diamonds have on the Canadian market is the length of time necessary to supply them, running from one to three months, and it is frequently necessary to obtain the diamond without such delay. One of these diamonds was installed in the tracks of the Canadian Northern Ontario Railway, and the Toronto Street Railway at Queen Street East, in January, 1908, and has given perfect satisfaction. It is absolutely necessary to have a perfectly solid foundation for these diamonds, and as such is the exception of new construction, it has been found advisable to put in a built-up diamond for a sufficient period to guard against any settlement in the grade and then the renewal diamond may be ordered of the manganese type.

In cases where the angle of the crossing is less than 15 degrees, it is sometimes desirable to put in a movable point frog, Fig. 4. With such a small angle, the distance between the frog points of an ordinary diamond is so great that the wheel is unprotected to a danegrous degree. This method consists of two sets of short switch points placed face to face between two bent rails. They are moved in opposite directions at the same time, either by direct connection with a double-throwing stand, or by a "T," or oppositely-acting bell cranks connecting with an ordinary stand, or with interlocking apparatus. Fig. 4 shows this arrangement for the crossing of the Canadian Northern Railway and Grand Trunk Railway, at Rockland, Ont. The angle of this crossing was 9 degrees and 46 minutes, which would have allowed 28 inches between frog points of the ordinary diamond, and the liability to derailment was in such a case obviously too great. This crossing cost $160 installed, and is giving perfect satisfaction.

Signal Tower.

The central machine controlling the interlocking is situated in a tower built usually 9 feet clear of the nearest rail, or with 22 feet clearance, when a second track is to be provided for, in the angle of the diamond affording the best view of the tracks for the operator. The size of these cabins depends, of course, on the size of the machine installed, but the standard for single track installation is 12 feet by 14 feet.

One feature of the design of a tower may be questioned, and that is the location of the stairway. In countries of mild climate throughout the year there is little doubt that an outside stairway is preferable. However, in a climate such as we have in Canada, the inside stairway has decided advantages. The danger and difficulty of snow on the stairway is removed, and, having the heater on the ground floor, the operator must pass it sufficiently to keep it in order and prevent the danger arising from an overheated stove. A strong argument against the inside idea is that it necessitates a trap door in the floor, but if this is properly counterbalanced, little danger can be met with if ordinary care is exercised on the part of those whose business necessitates them using the cabin.

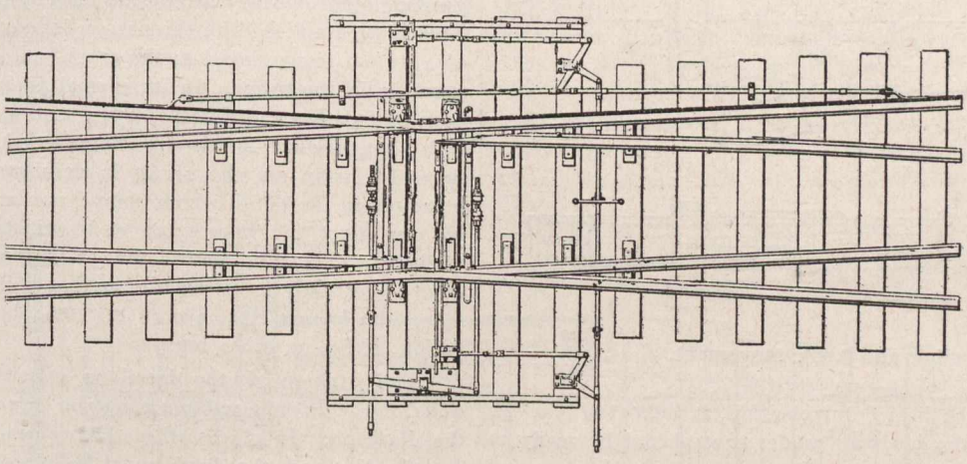


Fig. 4.

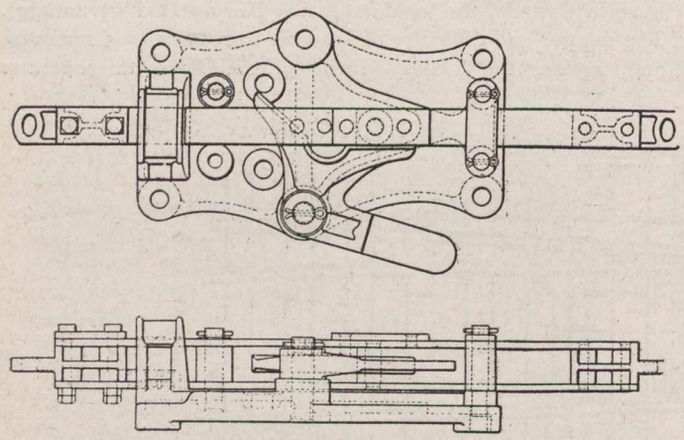
The cost of the signal cabin will vary according to its location, as in some parts of the country lumber can be purchased cheaper than in others. The average price of seven of these towers, built within the past two years, was found to be $508, and it is quite a fair price to assume.

Semaphores and Connections.

The semaphore signal was introduced on railways in England about 1841, by Mr. C. H. Gregory. Numerous other forms of fixed signals were used before its introduction and are still being used, but the semaphore is fast superseding all the others, and will undoubtedly become practically the ada and consists of a vertical post from 30 to 40 feet in height, only form in use. It is the recognized signal in use in Cancarrying a movable arm pivoted near the top of the post. This arm is usually capable of being moved through an arc of about 70 degrees, but sometimes moves as much as 90 degrees, and is the means adopted of communicating with the

engineer of the train as to whether he may, or not, proceed across the diamond. The mast is 30 feet in length, of which 5 feet is below the level of the ground when it is erected, and to add rigidity, a footing of 3-in. x 12-in. hemlock is built to it. It is made of 10-in. x 10-in. timber, tapered to 7-in. x 7-in., and the arm is 5 feet in length, made of well-seasoned ash. The casting into which the blade fits extends back of the mast and contains two spectacles on each side—one red and the other green. This constitutes the means of communication at night, for it can be seen from the drawing that with the blade in the horizontal, or normal, position, the spectacle covering the lamp is the red one, whereas if the arm is lowered to the "clear" position, the green one covers the lamp.

The arrangement of semaphores on a single track grade crossing is as follows:—A home signal is erected in each of the four different directions from the diamond, 50 feet beyond the derail point, which usually brings this signal 550 feet from the intersection of the two lines. This signal governs movements of trains advancing toward the diamond and indicates when horizontal that the trains must stop, and that the derail is open. The home semaphore is distinguished from the distant semaphore by having a square ended blade, whereas the distant blade has a fish-tail end. When the home signal is "cleared," that is, when the arm falls to an angle of about 60 degrees below the horizontal, it indicates that the engineer has a clear line to proceed. When the distant



Switch and Lock Movement.

semaphore is in the horizontal position, it indicates that the engineer must bring his train under control and be ready to stop at the home semaphore. These same signals are communicated at night by the green and red lights in the manner already described.

It is worthy of note that the Railway Signal Association, a few months ago, adopted the green light as the only "clear" signal. This provision is a wise one, as it overcomes the difficulty of ordinary house lamps, lanterns and other such lights being mistaken for a "clear" signal. The red light, as in the past, indicates the danger signal.

Semaphore posts are made usually of wood, although some companies, as in the case of the Grand Trunk Pacific Railway, have a standard post of iron. Such construction, however, is only possible under exceptional conditions as few companies can afford such a heavy charge against initial construction.

The methods of connecting the semaphores with the tower are varied according to the specifications of the various companies. With the distant semaphore only wire is possible, as the distance is too great for the operation of rod connection. There are, however, two methods in the use of wire connections, namely, single and double lines. In the case of the former, a counter weight is used to keep the signal in the horizontal or normal position. The wire line connects with a lever, the outer end of which carries the counterweight, and when the cabin lever is reversed, the wire connection pulls this lever down and the counterweight rises, permitting the semaphore blade to drop to the "clear" position. The double wire method has a wire controlling each movement. The disadvantage in this, however, lies in the fact that if trees or other obstacles fall across the wire lines and break them, the semaphore becomes useless and may or may not register a "danger" signal. In the case of a single wire breaking, the counterweight always carries the blade to "danger." This is in accordance with the requirement of the Board of Trade, the governing board of railway operation in Great Britain, and is certainly an important argument in favor of its use.

Pipe connections to the home signals are a requirement in many of the American Specifications, and a description of them will follow in connection with derails. Whether they are an improvement on wire connections, or not, will be taken up later in bringing forth certain points which are at present in doubt in Canadian practice.

The class of wire used in Canada is mostly of the stranded variety, which has some advantages over the solid wire. They are thoroughly galvanized, and in making a splice the result is much better than in the case of a solid wire connection.

To carry the wires, from the lead-out to signals, posts are used with pulley wheel connections. Some companies require square posts, but the ordinary, round cedar post is generally used. They are about three to four feet above the grade level, and usually about six inches in diameter.

Derails and Connections.

In order to protect a train while crossing the diamond, from the approach of another train on the other tracks, semaphores are used as already described. This does not, however, control the actions of the engineer in his cab, but only acts as a signal to him, and in case these should be disregarded, other means had to be employed to insure safety. This is accomplished by the use of derails. A derail consists of a switch-point placed in the track and connected with the machine in the tower. In its normal position, it has already been stated that the derail is open, and it can, therefore, be seen that, if the signals are disregarded, and the engineer takes his train on, the result is derailment. There is one principle in the derail which should not be overlooked, namely, the effect the knowledge of its existence has upon the engineer. The man knows that it is open, and that derailment is certainly awaiting him at that point. This alone will make him keep a close eye on his semaphores for self-preservation, if for no other reason.

The position of the derail is governed by the regulations of the Board, and must not be less than 500 feet from the diamond. In places where heavy grades exist approaching the diamond, the derail must be placed so as to give the equivalent of 500 feet on a level grade. This increased distance, of course, will depend upon the class of rolling stock and speed of trains as well as the percentage of grade.

Guard rails are used to keep the wheels from jumping off the ties as soon as they are derailed. The requirements of these are that they extend from a point six feet in advance of derail and extend thence toward the diamond, a distance of not less than 400 feet. The guard rails should always be properly connected throughout and spiked as ordinary track. From the latest regulations of the Board of Railway Commissioners, it will be noticed that the guard rail is to be placed on the inside of the curve where practicable. This seems to be questionable practice as it must not be forgotten that the fundamental idea of the derailing point is to derail. The tendency on a true curve is to have greater stress on the outside rail, and as there is generally a certain amount of rocking motion, especially near the end of the curve, it is questionable whether the wheels may not jump the derail point in some isolated case of peculiar circumstances. The duty of the derail is plain, and it would be well to insure its work by placing it in the outside rail. If the derail point is successful on the inside of the curve it would indeed be a difficult matter to estimate what the difference in damage to roadbed would be as compared to the point in the outside rail. When an engine leaves the rails, its enormous weight, together with its momentum, reduces ties to a useless mass of broken tim-

ber, and guard rails become more an ideal than useful protection.

The connection between a derail, or switch, and the tower, is made by the use of one-inch soft steel or wrought-iron pipe. The pipe is carried on a series of pipe carriers placed 4 feet 6 inches outside of the rail. These pipe carriers may have box or concrete foundations. The box type consists of a box built with no bottom or top, which, when sent into the grade on one end, permits the earth to be tamped into it until it becomes rigid. The carrier is then fastened to the top. There is serious objection to placing concrete foundations for these carriers in the grade of a newly constructed railway, as such grade will continue to settle during the first couple of years after construction, and any settlement beneath a concrete foundation has fatal effects upon it.

The methods of making joints in pipe lines have been largely discussed within the last few months. Some signal companies have simply used sleeves, but the threading of the pipe undoubtedly weakens it, and the recent rulings of the Board call for the plugging of all joints with six-inch wrought iron or soft steel plugs, rivetted with ¼-inch rivets. This appears to be the universal practice in England and the United States, and seems to be a move in the direction of greater efficiency.

In order to take care of the expansion and contraction in pipe lines, due to climatic conditions, compensators are used.

The protection afforded at the derail is ingenious and comprehensive. Fig. 6. By reversing the lower lever, the "L" crank operates the "T" crank which throws the detector bar by one arm and closes and locks the derail by the other.

The derail point is, of course, interlocked in the machines, but as a further safeguard against any opening of the derail point, by agencies other than the lever, it is necessary to have a lock on the derail itself operated through the action of the lever in the tower. This is accomplished by having a locking bar, attached to the derail, which passes through a bracket on the end of the derail-motion-plate. It is slotted to the width of a strip of steel fitted onto the underside of the motion-plate-slide-bar. When derail lever is reversed and point closed the "T" crank operates the motion-plate-crank, which in turn throws the derail point. The locking-bar alluded to above is, of course, operated by the derail point, and thus the slot in the locking bar and the locking strip, on the bottom of the motion-plate-slide-bar come together simultaneously at the end of stroke of lever. The result is that this locking strip fits into slot in locking bar and thus locks the derail point close to the stock rail, making it impossible for the derail point to be opened by any agency other than derail lever.

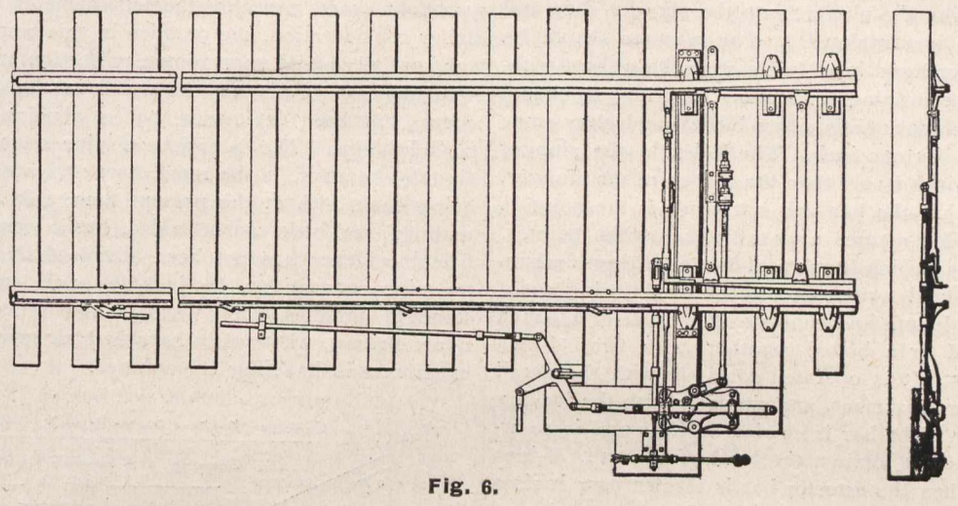


Fig. 6.

The action of the wire lock is simple and effective. Its function is to prevent the home semaphore being "cleared" while the derail is open or partially closed. When the tower lever, operating the derail, is reversed and the stroke completed the semaphore lever is released in the machine and without the action of a wire lock it would be possible to "clear" the semaphore with the point slightly open, caused perhaps by a small stone between the derail and the stock rail. The wire-lock-derail-connection passes through the casting and has two positions, namely, an outward and inward one, depending upon the position of the derail point. When the point is closed, the bar is consequently thrown over to the outward position, and the slot in the wire-lock-derail-connection, permitting the one to slide through the other. This action allows the semaphore lever to be thrown, "clearing" the line.

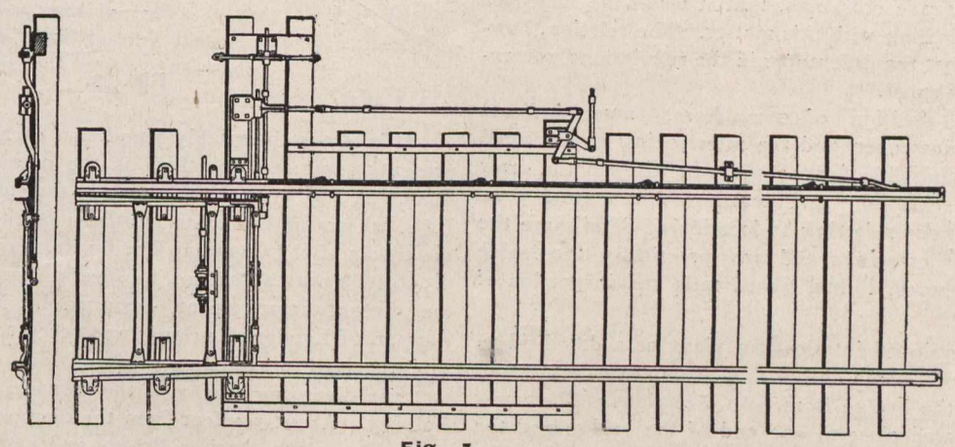


Fig. 7.

The facing point lock is another method of accomplishing the locking of a point, but necessitates another lever in the machine, Fig. 7. It is used to interlock switches which occur between derail points and the signal cabin, as this is a requirement of the Board. In this movement, one lever is used to operate switch points and the other for the facing point lock and detector bar. The interlocking in the machine is so arranged that it is necessary to pull both levers before the home semaphore can be operated. The lever operating

the switch operates the wire-lock connection in a similar way to the switch and lock movement; the action being the first to reverse the switch lever, which closes the points, then throw the locking lever, and finally "clear" the semaphore.

Between the tie plate and wire-lock-switch-connection a small bar is placed which is connected up with the plunger-slide. This plunger-slide has a motion identical with the wire-lock-switch-connection, and when the point is thrown over, the plunger and wire-lock-switch-connection bars move in unison with it and are then in a position to be locked. The facing point lock lever is then thrown operating the detector bar and driving the plunger into the plunger slide and the locking action is completed. The plunger should be made with a blunt end and be of full section throughout without chamfer. In performing its locking functions it should lock through the plunger slide seven inches, and clear same in normal position by one inch. The holes in the plunger slide should be 1-6-inch larger than the section of the plunger, and so arranged that the bar will not enter if the point is open 3-16-inch. This insures a close fitting switch point.

The detector bar which forms part of the locking mechanism on both lock and switch movements and facing point locks, is 50 feet in length and consists of 3 pieces of 2¼-inch by 7-16-inch rolled iron bolted together with two ¾-inch counter sunk bolts. It is operated concisely with the derail point in the former movement, and similarly with the locking levers in the latter. The bar is carried on clips and is so arranged that it lies flat against the head of the rail, ¼-inch below the top. When the detector bar is thrown over it rises to a height of one inch above the rail and on completion of stroke falls again to its original level. The purpose of this bar is to prevent the switch point being unlocked during the passage of a train. As the bar is longer than the distance between trucks it is evident that, if attempted, the detector bar would strike the wheel base and be prevented from completing its semi-circular motion, and, as a consequence, the plunger cannot be withdrawn from its locked position.

Interlocking and Drawbridges.

So closely is the subject of interlocking at drawbridges allied to that of grade crossings, that it would be improper to overlook it in dealing with this matter. The relation, however, is so close that the differences in the regulations governing same are very small.

The normal position of semaphores must indicate danger, derail points open and the interlocking so arranged that it will be impossible for the operator to open the draw span unless the semaphore and derails are in normal position. The conditions referring to location of derails are the same as at grade crossings and are practically the same governing semaphores, lights, guard rails and inspection of plants.

In a fully equipped interlocking plant at a drawbridge, we have the derails, home and distant semaphores protecting the approach to the bridge from both directions. The tower is generally situated close to one end of the bridge and the pipe lines crossing it to the derail and to operate the wire connections to the semaphores are, of course, broken at each end of the bridge. The method of connection is interesting. At the point where they break, a lug is fastened to the underside of the pipe, which fits into a socket attached to the other pipe. Thus the action of the signalman, prior to the opening of the draw is as follows:—A lever is thrown which lifts the ends of all pipe lines on the bridge at the farthest side from the tower; this lifts the lugs out of the sockets, breaking all connections at that end. The operation is then repeated for the end of the bridge near the tower, and this action not only disconnects the same pipe lines at this end but also the pipe line controlling the disconnection action at the other end. This leaves the bridge free to the action of the bridge tenders.

A fully equipped plant, however, is not always necessary to provide sufficient protection, and frequently a modified plant is ordered, consisting of one semaphore on each side of the bridge and situated 800 feet therefrom. They are operated by levers and wire connections from platforms at each end of the bridge. Similar plants to this were installed in the year 1907, on the line of the Canadian Northern Railway at Gamebridge and Bala Park; the former crossing the Trent Canal and the latter the navigable outlet of Lake Muskoka to Bala Bay. A plant of this description costs about $200 installed.

Conclusion.

Prior to the formation of the Board of Railway Commissioners, conditions were, as already stated, such that little attempt was made to standardize the interlocking plants. A general improvement has taken place, however, within the past four years, and after the settlement of a few points still under consideration, the practice in this country will be very substantially based upon proper protection at reasonable cost. The question of placing the derail in the outside rail upon curves has been dealt with, but is a point worthy of much consideration. The adoption of pipe connections to home signals, however, is the most discussed and important point being dealt with at the present time. It has already been outlined, and little can be added, but it would seem that sufficient evidence has not been advanced by those supporting the pipe connections, to include such equipment in the standard practice here, when it is positively forbidden in Great Britain, where they have had already over 68 years of experience in handling semaphores.

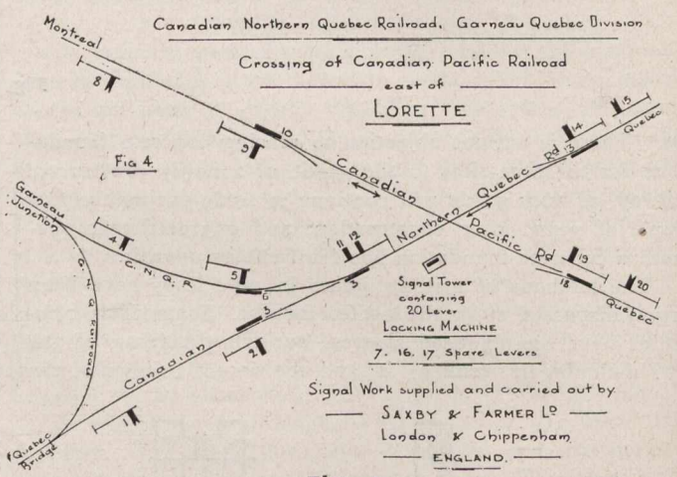


Fig. 8.

It is almost invariably found that each interlocking plant presents some feature which is the outcome of local conditions. In Fig. 8, we have a plan of the conditions at Lorette, P.Q., where the Canadian Northern Quebec Railway crosses the tracks of the Canadian Pacific Railway. In this case, the proposition was submitted to several signal companies, and the present arrangement, designed by Messrs. Saxby and Farmer, of London, England, was accepted. The difficulty in this case was in getting a scheme which would properly protect the diverging tracks of the Canadian Northern Quebec Railway. About 500 feet from the diamond, the switch point of the branch to Quebec Bridge is located and this complicated matters. It was accomplished, however, by putting in a junction signal which indicates the route open for traffic, and placing the derail in on each line, about 150 feet in advance of the switch point, and the home signals in advance of these by the usual distance. A distant signal was, of course, required 1,200 feet in advance of each home signal. The complete installation required 17 levers to operate it, but a 20-lever machine was put in, giving 3 spare ones for future development. The cost of this plant installed was $5,895, which included the signal cabin.

In the case of the installation at Hawkesbury, Ont., governing the crossing of the Grand Trunk Railway tracks and those of the Canadian Northern Ontario Railway, two conditions arose uncommon to the average plant. From the intersection of tracks, running in a northerly direction along the Grand Trunk Railway, a descending grade of over one per cent. was found and Hawkesbury station was only about 1,900 feet distant from the intersection. This brought the distant semaphore near the station, and if a train pulled out

and found the home signal against it, it would be necessary to back to the station again in order to climb the grade. To overcome this condition, a telephone was installed in the cabin with connection at the station in order that the operator could be informed of the train movement and keep the line clear.

The second condition was in the matter of placing the derail east of the diamond on the Canadian Northern Ontario Railway, where it was found that 500 feet would interfere with the proper operation of the yard. In this case, the Board of Railway Commissioners sanctioned the position of derail at 400 feet, which made a satisfactory settlement of the difficulty.

The cost of single track grade crossing, protected by derails and home and distant semaphores, is made up as follows:—An easer rail diamond (ordinary type), $350; signal cabin complete, $525; interlocking and signal plant, $3,600; extras for incidentals, say, $100; total, $4,575. This amount may vary a slight degree either way as local conditions governing cost of labor and materials differ somewhat. It is, however, a close estimate of the present cost of such a plant.

The first cost of an interlocking plant is not as serious, however, as the future maintenance and operation, which amounts to about $100 a month, made up of wages for two signalmen at $45 per month each, and the balance in supplies and repairs. If $1,200 per annum be capitalized at 5 per cent., it amounts to $24,000, to which can be added the saving of the cost of grade crossing, making a total of approximately $30,000. It would thus pay a company to put that amount into the cost of any scheme which would eliminate the grade crossing, without taking into account the great advantage of having no delays to traffic and risk of accident.

ESTIMATING THE VALUE OF A WATER POWER.

Charles T. Main, Mill Engineer, Boston, Mass.

A water power may be of more value for one kind of business than another, and its value is very largely determined by its location. But passing these by for the present, the value of a water power depends upon:—

The quantity of water, the fall, and the uniformity of flow during the year and for a succession of years. This is an axiom, and we should be obliged to go no further than this to dispose of the method of estimating values as stated at the outset. The effect of the fall is to increase or decrease the cost of construction per horse-power. If the fall is low, the cost per horse-power of plant will be very much more than that for a high head. The value of that power of low head cannot be as great as that for the high head, other things being equal, for the first cost of plant and the fixed expenses, such as interest, depreciation, repairs, taxation, and insurance will be greater for the lower head per horse-power; so also will be the running expenses; and to get the same return for the money expended, as more money is required in the construction of the plant with a low head, less value can be placed on the power itself.

The effect of variable flow upon the value is more difficult to estimate, and to determine at what point of variability the power becomes of no value.

Other things being equal, the value of a water power depends very largely upon its location.

If the value of the water power varied directly as the cost of fuel, then the farther away from a railroad the power is located, and the more it costs to haul coal to it, the more valuable would be the power. If there is raw material to be brought to the mill and finished product to be taken away, it is a self-evident fact that the nearer the railroad or seaport the mill can be located the more valuable the power which drives it. This reasoning can be carried to reductio ad absurdum by saying that a water power is more valuable in the wilds of Maine, where there is no railroad, and consequently where fuel is expensive, than in Lawrence, Lowell, or Manchester.

The value depends largely upon the fact whether or not the social conditions are or can be made such as to cause good operatives to locate and remain in the place; upon the sanitary conditions; and sometimes even, in the case of a developed power, upon the management of municipal or town government. All of which cannot be estimated in dollars and cents, but which determine to a certain extent the profits or losses.

There is in almost every business need for steam for other purposes than power, if for no other purpose, in colder climates, than for warming the buildings in cold weather. This steam can usually be used after being exhausted from an engine, requiring the consumption of little or no more fuel than is required to produce steam for the engine alone.

The plant required for producing the steam is a necessity when water is used for power, and should be included in the cost of power plant, and the expense of running included in the cost of producing power. This item may be so large as to make a positive loss by running the boiler plant for steam for heating and using water for power, over and above the cost of producing the power by a steam plant and using the exhaust steam for heating purposes.

CEMENT BRICK CONSTRUCTION IN THE NEW PLYMOUTH CORDAGE COMPANY'S MILL.

The new No. 3 Mill recently erected by the Plymouth Cordage Co. at Plymouth, Mass., is distinguished by the fact that it is built entirely of cement brick (not concrete brick) made upon the ground. Two other mills of this company had previously been built of clay brick, but when the third mill was planned the price of such brick was extremely high. As the company owned a huge bank of clean, sharp, silicious sand and a bed of gravel containing a liberal percentage of stone, it was decided, after preliminary tests on short-time set, to use cement brick. The outside profits were thereby minimized and the entire work was conducted by a force built up from the regular organization.

The mill is about 114 ft. wide by 430 ft. long, with two stories and a basement. For the entire work of construction about 2,400,000 cement bricks were used, requiring about 7,500 barrels of cement for making. The bricks were made in four standard cement brick machines, operated by hand. Each machine made twenty bricks at a time. The mixture generally used was three parts sand to one part cement. For lightly loaded walls a few brick were made of four parts sand to one cement. The experience gained in the construction of this building led the owners to the opinion that for any ordinary building work these brick could be made safely in proportion of four and five parts sand to one of cement. All brick used on the outside of the buildings had a facing (1/8-inch thick after compression) of two parts fine sand and one part cement, with the addition of 2 per cent. waterproofing to the cement. Enough water was used to make a mortar of such consistency that it would hold its shape under compression without flushing water to the surface so as to cause the mortar to stick to the plates. The amount of water used averaged about 8 per cent. Although this amount would seem likely to produce a porous brick having a strong attraction for water, it was shown by tests that the bricks so made were quite impervious. The cement bricks appear to greater advantage as compared with clay bricks in regard to the bond. In fact, the former formed such perfect bond with the mortar that the resulting wall was practically monolithic. A valuable feature of the cement brick appears in the ability to cut it for special places. It was possible to make a cut half an inch thick for the full length of the brick and width. In the laying of cement brick anything can be done that it is possible to do with faced brick, every brick being the same in all dimensions, equal in appearance and quality, requiring no culling.

(Continued on Page 136.)

A PAGE OF COSTS
ACTUAL, ESTIMATED and CONTRACTED

SOME DATA WITH REGARD TO THE COST OF MAKING TEST BORINGS.

A. C. D. Blanchard, A.M. Can. Soc. C.E., Asst. Engineer, City of Toronto.

The borings enumerated below were made in the city of Toronto during the last year in order to find the character of the soil to a depth of from thirty to seventy feet. These borings were made in connection with several works which were about to be built, and were taken in different parts of the city.

The ground met with consisted chiefly of blue clay, although seven borings were made in wet, sandy clay, and four were made in filled ground. The average length of holes are shown for each locality. The borings were all made with a 1½-in. carpenter's machine auger, welded to the end of a ¾-in. pipe. The ¾-in. pipe was cut in sections 6 feet long, and each length was added as it became necessary.

In the process of boring the auger was turned by two or three men with Stillson Wrenches, at the surface. The heavier clay required three men to turn the auger. After the auger had bored from 8 to 12 inches it had to be removed from the hole and cleaned and then replaced in the hole, and continued for another auger length. Considerable time was thus lost in having to remove the auger and getting it back to its position again especially after the hole became quite deep. Samples were taken from each boring and bottled.

The force consisted of one recorder and three laborers each at $2 a day. The work was done at all seasons of the year, and no time was lost by any of the men.

The cost of blacksmith work and teaming amounted to about 5 per cent. of the total cost, and the cost of material, such as augers, wrenches, and iron pipe, amounted to about 10 per cent. The following is a statement of the itemized cost of the work:—

Location.	Character of ground.	No. of holes.	Total No. of feet.	Ave. depth of holes.	Labor.	Material & Blacksmith proportioned.	Total cost.	Cost per foot.
								Cents.
Adelaide and Front Sts.....	Heavy blue clay—10′ red clay on top....	28	709	25.3′	$199.11	$33.60	$232.71	32.8
Stanley Park	Made ground.....	4	90	22.5′	44.11	4.80	48.91	54.2
In Don ravine and flats	Fine, running, clayey sand.....	36	1,163	32.3′	292.64	43.20	335.84	28.8
Bickford ravine ..	Heavy clay.....	7	152	21.7′	48.39	8.40	56.79	37.3
East of Don, 1,000′ north of Queen..	Heavy blue clay.....	5	160	32.0′	40.00	6.00	46.00	28.7
		80	2,274		$624.25	$96.00	$720.25	

COMPARATIVE COST OF HAND AND STEAM DRILLING IN ROCK.*

In the city of Hamilton the sewer on Princess Street was 24 feet deep in solid rock.

Steam drills were used on this section for some time, but, owing to the peculiar red shale rock formation the drills choked very quickly, and after comparing the cost of drilling by steam and by hand, it was found that the hand work was cheapest; therefore, the steam drills were stopped and the work carried on by hand. The comparative cost of drilling by steam and by hand was as follows, viz.:—

ROCK DRILLING BY STEAM.

Length of holes in rock.	Labor at 20c. hr. Total.	Cost per ft.	Engineer. Total.	Cost per ft.	Coal. Total.	Cost per ft.	Total cost.	Total cost per ft.
512 ft.	$71.50	.13⁹	$9.00	.01⁷	$16.43	.03₂	$96.93	.19

ROCK DRILLING BY HAND.

270 ft.	$37.80	.14	.....	...	.....	..	$37.80	.14

*From information furnished by A. F. Macallum, C.E., City Engineer, Hamilton.

COST OF EIGHT INCH SEWER.

The city of Fredericton, N.B., laid two sections of eight-inch terra cotta sewer. The following table gives the unit cost, and total cost. The difference in depth being about four feet.

WATERLOO ROAD.

No. manholes.	No. cu. yds. brickwork.	Total cost of brickwork.	Cost per cubic yard.	Length of sewer in feet.	Average cut in feet.	No. cubic yards excavation.	Cost excavation including sheeting.	Cost excavation per cubic yard. Cents.	Total cost pipe laying.	Cost pipe laying per lineal ft. with cement. Cents.	Total cost.	Total cost per lineal foot. Cents.
2	5.98	$83.10	$13.85	495	9.7	533.5	$274.97	51.5	$20.72	.04	$461.44	.93

PHOENIX SQUARE AND CAMPBELL STREET.

3	4.32	$54.00	$12.50	811	5.8	522.5	$195.30	37.4	$27.70	.034	$425.15	.52

COST OF PUMPING WATER BY VARIOUS METHODS.

The Board of Water Commissioners, of Duluth, Minn., use steam, gasoline, gas and electricity for pumping water. The figures in their annual report are of considerable interest because of this comparison of costs, but because of breaks in the pump, the comparisons are not quite so good as they otherwise would have been.

Steam shows up to best advantage—with electricity next.

Pumping Water Records, Duluth, Minn., 1908.

	Water Pumped, Gallons.	COST: Coal, Electricity, Gas, Gasoline.	Labor.	Miscellaneous Materials.	Miscellaneous Repairs.	Aggregate Cost.	Cost per 1,000 Gallons. Cents.	REMARKS.
Lakewood	2,124,780,000	$11,885.26	$6,229.29	$303.52	$ 50.13	$18,468.20	.86 9-10	
Middle System	108,474,399	1,406.32	938.98	44.25	71.66	2,461.21	2.26 9-10	Break of pump.
Woodland System	11,325,619	143.20	468.63	5.38	298.50	915.71	8.08 5-10	Expensive break of pump.
Duluth Heights	4,258,893	74.60	300.00	11.82	.75	387.17	9.09	Labor expense increase rate
Booster Pump	15,390,000	74.35	71.77	16.00	.....	162.12	1.05 3-10	

December only.

EXPENSE OF PUMPING 1,000 GALLONS WITH FUEL ONLY.

Lakewood.....with Steam . ..... 4 tenths of 1 cent; Head 290 feet
Lakewood.....with Electricity . ..... 6½ tenths of 1 cent " 290 "
Duluth Heights.....with Gasoline . .....17½ tenths of 1 cent; Head 169 feet Equalized to 290 feet=30 tenths of 1 cent
Booster Pump.....with Electricity . ..... 4 4-5 tenths of 1 cent; Head 70 feet; Equalized to 290 feet=20 tenths of 1 cent
Middle System.....with Gas . .....13 tenths of 1 cent; Head 266 feet; Equalized to 290 feet=14⅓ tenths of 1 cent
Woodland System.....with Gas . .....14.4 tenths of 1 cent; Head 300 feet; Equalized to 290 feet=13 9-10 tenths of 1 ct

COST OF STEAM SHOVEL EXCAVATION.*

On the construction work of the C. M. & St. P. Coast extension there were many large fills and from one steam shovel pit, the Newcomb, some 250,000 cubic yards of material was taken.

The following tabulated statement shows the data of and cost of operations at this pit for the month of March, 1909:—

Shovel—Bucyrus No. 453, 2½ yd. dipper, 65 tons.

Engines—Prairie type, 3 in use; tractive power, 33,300 lbs.

Cars—Western dump, average load, 12.6 yds.

Trains—1 engine handling 13 loads, and caboose per train.

Yardage—68,000 cu. yds. handled in 27 working days, 10 hours each.

Yard Miles—308,780.

Average Haul—4.54 miles. Rate of ascending grade against loads, 88.00 ft. per mile.

Total Cost, Labor—		
Steam shovel roll	$1,815.64	
Section labor	99.94	$1,915.58
Work Train Service—		
Conductors, 95.8 at 3.68	352.54	
Brakemen, 191.6 at 2.53	484.75	
Engineers, 95.8 at 4.40	421.52	
Firemen, 95.8 at 2.95	282.61	
768 tons coal at $4.00	3,072.00	
1,916,000 gals. water (255,466 cu. ft. at .07 —100 ft.)	178.83	
95.8 Eng. days for supplies at .32	30.66	
81.0 Eng. days for depreciation at $2.03	164.43	
81.0 Eng. days for repairs at $3.00	243.00	
8.10 Eng. days for interest at $2.03	164.43	5,394.77
Coal Used by Steam Shovel—		
172.8 tons coal at $4.00	691.20	691.20
Less Camp Credits (Profits)—		
Boarding camp	174.27	
Commissary	15.74	190.01
68,000 cu. yards handled during month—		$7,811.49

$7,811.49 ÷ 68,000 = $0.1148 per yard.

*Adapted from an article in the Railway Review.

METHODS OF EXAMINATION OF BITUMINOUS MATERIALS FOR ROAD CONSTRUCTION.*

By Clifford Richardson and C. N. Forrest.

So much attention has been directed of late to the problem of bituminous highway construction, and so many enquiries have been made in regard to methods for the examination of bituminous materials in use for this purpose that it seems that it may be of interest and value to present thte methods in use in the New York Testing Laboratory, which have been based on an experience of twenty-two years in the study of various bitumens.

Specific Gravity.

The specific gravity of light oils is determined with a pyknometer or a Westphal balance at 25° C. Heavy substances, too viscous for test by the above instruments, are examined by the Kirschbraun method:—

Take a test tube about half an inch in diameter and cut it off to give a 1¾ in. by ½ in tube. Flare it out to carry a fine wire. Put about 10 grains of the oil or asphalt into it, and suspend it in an oven to remove air bubbles and drive off the water. Cool and weigh accurately in air and immerse in distilled water at 25° C. to a fixed mark on the wire and weigh. Previous to filling the tube with the sample, determine its weight carefully in air and in water at 25° C., immersed to the fixed mark. These weighings give the weights of the tube alone, in air and in water, and the combined weights of the tube and the sample, in air and water. The gravity is calculated in this way, representing—

Weight of tube in air..... a
Weight of tube and sample in air..... b
Weight of tube in water..... c
Weight of tube and sample in water..... d

$$\text{Sp. Gr.} = \frac{\text{Weight in air of sample}}{\text{Loss of weight in water}}$$

in this case becomes—

$$\frac{b - a}{(b - a) - (d - c)} \qquad (1)$$

When the gravity of the sample is less than unity, the second expression in the denominator is a negative (d — c) quantity, and is added to the original weight of the sample (b — a), inasmuch as the buoyancy of the sample will overcome its own weight, and, to a certain extent, will also reduce the weight of the tube in water, making c greater than d.

The formula in this case may be also expressed so:—

$$\frac{b - a}{(b - a) - (c - d)} \qquad (2)$$

When the gravity of the sample is greater than unity, d will be greater than c, and the first formula applies without confusion. As an example, take a blown oil, the gravity of which was determined in our laboratory according to this method:—

Weight of tube in air..... a = 4.7870
Weight of tube and sample in air..... b = 16.7900
Weight of tube in water, 25° C..... c = 2.8565
Weight of tube and sample in water..... d = 2.6425

by formula (2).

$$\text{Sp. gr.} = \frac{16.7900 - 4.7870}{(16.7900 - 4.7870) + (2.8665 - 2.6425)}$$

$$= \frac{12.0030}{12.2170} = .9817$$

This may seem a bit complicated at first, but it will be noticed that the factors a and c are constants, which can be used for the same tube without change, and the calculation becomes very simple after a few trials.

*A paper read at annual meeting of the American Society for Testing Materials, July, 1909.

The advantages of the method are in doing away with the inconveniences of handling a large amount of oil, and the ease with which air bubbles can be removed. Of course, it can be used only with oils which are viscous enough to be retained in the tube when under water.

Flash Test.

The flash point is determined in a New York State closed oil tester. The water bath is, of course, removed and the oil heated directly with a flame of a size to raise the temperature at the rate of 20° F. per minute, and a small flame from a capillary glass or metal tube is used for flashing. The flame should be applied at 5° intervals. The determination should be repeated for such oils as flash at unexpected temperatures. The water must be removed from the oil or flux before putting it in the tester cup, either by heat or by the centrifugal.

Bitumen Soluble in Carbon Disulphide, or Total Bitumen.

One gram of the dry material is weighed out and introduced into a 200 c.c. Erlenmeyer flask of Jena glass, and covered with about 100 c.c. of carbon disulphide. It is then set aside for at least five hours, or over night, at the temperature of the laboratory. In the meantime, a Gooch crucible is prepared with an asbestos felt and weighed. This Gooch crucible is of special form, with a large filtering surface. It holds 30 c.c., is 4.4 c.m. wide at the top, tapering to 3.6 c.m. at the bottom, and 2.6 c.m. deep. This is much better for percolation work than the usual narrow form of Gooch. The felt is made by beating up long-fibre Italian asbestos in a mortar, and suspending the finer particles in water and quickly pouring off from the coarse particles. Too much of the latter should not be removed, or the felt will be too dense. The decanted asbestos and water are shaken up, and what is found to be a proper amount poured into the crucible, which has, in the meantime, been attached to a vacuum filtering-flask by the proper glass and rubber connections. As soon as the asbestos has somewhat settled, the vacuum-pump is started and the felt firmly drawn on the bottom of the crucible. It is then dried, ignited and weighed.

After standing a proper time, the disulphide is decanted very carefully upon the filter, which is supported in the neck of a wide-mouthed flask and allowed to run through without suction. The flask, after being tipped to pour the first portion, is not again placed erect, in order to avoid stirring up any insoluble material, but is held at an angle on any suitable base, such as a clay chimney. After all the disulphide has been decanted, more is added and the insoluble matter shaken up with it. This is allowed to settle, and decanted as before, the insoluble matter being finally brought on the filter and washed with the solvent until clean. The excess of disulphide is allowed to evaporate from the Gooch crucible at the temperature of the room. It is then dried for a short time at 100° C. and weighed. The loss of weight is the percentage of bitumen soluble in carbon disulphide.

In the meantime, the filtrate, transferred to a platinum dish, is placed in a good draught and lighted. When all the disulphide has burned, the bitumen remaining in the dish is burned off over a lamp and the mineral residue, which escaped the filter, is weighed The weight is added to that of the Gooch crucible or subtracted from the per cent. of bitumen found without its consideration as a correction. Care must be used in this method of procedure that the solvent does not creep over the sides of the crucible and that the outside is free from bitumen before weighing. In order to avoid this, the crucible is preferably supported in the neck of a flask with three constrictions, the neck extending above the top of the crucible and the latter being covered with a watch-glass.

Naptha Soluble Bitumen.

One gram of the substance is weighed into a 200 c.c. Erlenmeyer flask, covered with naphtha, and allowed to stand, as in estimating total bitumen; in fact, the entire process is the same, with the exception that one or two precautions must be observed. It is well not to attempt to break up any lumps with a stirring rod, as the substance, especially

the softer asphalts, may then adhere to the rod or flask, and be difficult to detach. It may also be necessary to treat the substance with several portions of the solvent. No heat is applied at any time in the process, and the filtration is made without suction.

Character of Naptha Soluble Bitumen.

The filtrate containing the naptha soluble bitumen is evaporated spontaneously in a crystallizing dish until the naptha is expelled. At 77° F. the residue in the dish is tested with the fingers to ascertain whether it is merely oily or of a sticky and adhesive character.

Residual Coke or Fixed Carbon.

This determination should be made according to the method described for coal in the Journal of the American Chemical Society, 1899, Vol. 21, page 1116.

Place one gram of pure bitumen in a platinum crucible weighing 20 or 30 grams and having a tightly-fitting cover. Heat over the full flame of a Bunsen bruner for seven minutes. The crucible should be supported on a platinum triangle with the bottom 6 to 8 c.m. above the top of the burner. The flame should be fully 20 c.m. high when burning free, and the determination should be made in a place free from draughts. The upper surface of the cover should burn clear, but the under surface should remain covered with carbon.

The residue minus the small impurity of ash in the pure bitumen is the fixed carbon, which should be calculated to 100 per cent. with the volatile hydrocarbons, excluding the inorganic matter.

Paraffine Scale.

The distillation method is employed for this purpose. One hundred grams of the oil is distilled rapidly in a 6-oz. retort to dry coke. Five grams of the well-mixed distillate is treated in a 2-oz. flask with 25 c.c. Squibb's ether; after mixing together thoroughly, 25 c.c. Squibb's absolute alcohol is added, and the flask packed closely in a freezing mixture of finely crushed ice and salt for at least 30 minutes. Filter off the precipitate quickly by means of a suction pump, using a No. 575 C. S. & S. 9-c.m. hardened filter, cooled by the above freezing mixture in a suitable apparatus.

Rinse and wash the precipitate with 1 to 1 Squibb's alcohol and ether mixture, cooled to 0° F. until free from oil. Fifty c.c. of the wash solution is usually sufficient. When sucked dry, remove the paper, transfer the waxy precipitate to a small glass crystallizing dish. Dry on a steam bath and determine the weight of paraffine scale remaining in the dish.

$$\frac{\text{Weight of paraffine}}{\text{Distillate taken}} \times \frac{\%}{\text{Original distillate}} = \%\text{paraffine scale.}$$

Viscosity.

The viscosity of bituminous road materials is determined in the Engler viscosimeter at any temperature desired. The full quantity, 250 c.c., is placed in the apparatus and raised to the temperature at which it is desired to make the test. One hundred c.c. is then permitted to flow into a graduated flask of the above capacity, and the time of flow in seconds noted. The result may be expressed either in seconds or by ratio compared with the time of flow of a similar quantity of water at 77° F.

Road binders should be too viscous for testing in the Engler apparatus at temperatures below 250 to 350° F., and to determine the consistency of such materials at normal or slightly elevated temperatures, the New York Testing Laboratory float apparatus is employed.*

The apparatus, which is made by Howard & Morse, Brooklyn, N.Y., consists of two parts.

In using the apparatus, the brass collar is placed upon a brass plate, the surface of which has been amalgamated, and filled with the bitumen under examination, after it has been softened sufficiently to flow freely by gentle beating. The collar must be level-full, and as soon as the bitumen has cooled sufficiently to handle it is placed in ice water at 41° F. for fifteen minutes. It is then attached to a float and immediately placed upon the surface of the water, which is maintained at 90° F. or any other temperature desired.

As the plug of bitumen in the brass collar becomes warm and fluid, it is gradully forced out of the collar, and as soon as the water gains entrance to the saucer the entire apparatus sinks below the surface of the same. The time, in seconds, elapsing between placing the apparatus on the water and when it sinks, is determined most conveniently by means of a stop watch, and is considered as the consistency of the bitumen under examination.

Cementing Value.

Petroleum oils have very feeble, if any, cementing value. Materials requiring a high temperature to flow freely will not adhere to cold road metal. To determine these properties the material under examination is heated to the temperature at which it is used in practical work, and a portion is then flowed over the surface of a slab of marble or glass, 4 in. x 5 in. x 1 in. thick. After standing twenty-four hours at 77° F., the film upon the stone must be decidedly sticky when tested with the fingers, and must adhere to the stone so that it cannot be pulled off.

Volatile Substances.

One hundred grams of the material is placed in a 6-oz. tubulated glass retort, with the bulb of an accurate thermometer immersed in the same. Heat is now applied so that the temperature rises at the rate of 10° per minute to 700° F. The distillate, if any, is regarded as the amount of volatile substances in the material. The residue is examined by the New York Testing Laboratory float for consistency, and compared with the results obtained upon the original material by this test.

* See Eng. Rec., Vol. 59, p. 584, May 1st, 1909.

GARBAGE DESTRUCTION BY INCINERATOR.

T. H. Whitelaw, B.A. M.B., Medical Health Officer, Edmonton, Alta.

The proper disposal of garbage is one of the most difficult problems which confront a health officer. The problem can, however, be solved by any city or town whose ratepayers are willing to pay the price for its destruction in a manner which will not be an offence to the neighborhood. The essentials are first, to have garbage collected at sufficiently frequent intervals by a properly equipped scavenging department, and conveyed to a suitable place for its destruction; secondly, it must be completely cremated by fire and thirdly, this must be effected in such a manner as not to cause a nuisance. These measures necessarily entail a heavy expense on a municipality, but which from a health standpoint is perfectly justifiable, nevertheless, though the value of such measures is generally not properly appreciated by the public or by municipal councils.

The disposal and destruction of garbage in Edmonton presents some difficulties which will not be met with in the older provinces, and adds greatly to the expense of the scavenging department of our city. The soil surrounding Edmonton is so rich and apparently so inexhaustible that manure has no commercial value. Hence the necessity arises of destroying almost the entire product of stables, public and private. Previous to August, 1908, all garbage, refuse, dead animals and manure was deposited in the Nuisance Ground and afterwards burned in the open. This process was necessarily slow and the whole neighborhood continually reeked with the fumes and smoke resulting. Night soil was deposited in trenches which when full were covered with a large heap of manure, the reduction of which to ashes afterwards by burning, was supposed to effectually cover and render innocuous the contents of these trenches. Owing to the unexpectedly rapid growth of our city, this nuisance ground eventually became the centre of an inhabited district and it

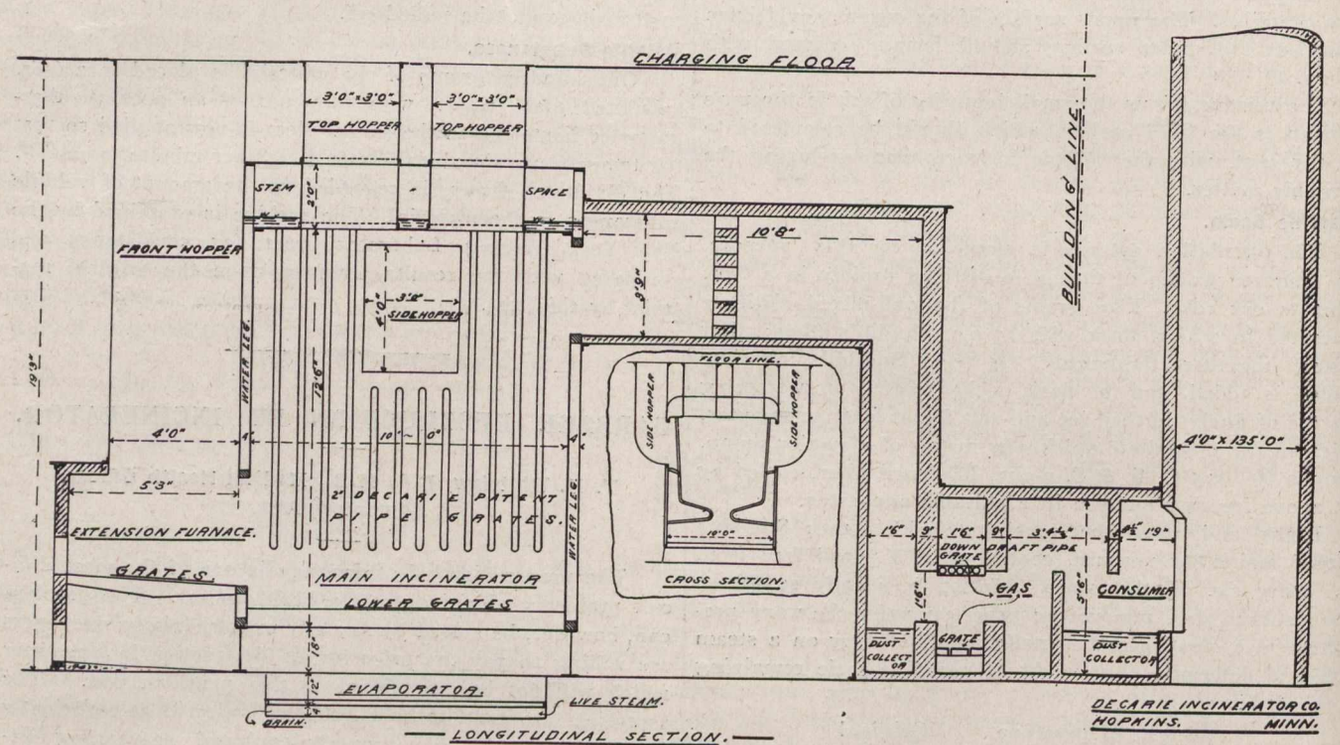
became necessary to adopt some method of destruction which would not be an offence to the citizens in the neighborhood, consequently in August of this year the Decarie Incinerator purchased by the city began operations on the site of this nuisance ground. This incinerator has a capacity of 50 tons per day and cost $41,875.66.

The combustion chamber of this plant is 10′ x 10′ x 10′, and it is simply a huge furnace surrounded by a water jacket. The grates below are about two feet above the pit into which the ashes fall, together with any liquids which may be drained off. The bottom of this ash and clinker pit under the grates is lined with steam piping connected to the water jacket boiler, and all fluids from semi-liquid garbage or night soil are here evaporated, and are drawn by the draft up through the furnace to the smoke stack. Above the grates are a series of inverted V-pipes on each side connected with the water jacket, and through which water continually circulates. These tubes are all double extra strength and are capable of sustaining a great load, and hold in suspension the greater part of the garbage and manure while undergoing the drying process, at the same time preventing the choking of the grates below on which most of the combustion takes place. On the upper floor of the building, into which all the garbage wagons are driven, over a bridge, are the hoppers, which are flush with the floor. Four of these are used for material requiring drying and open directly above the system of steam V-shaped pipes already described. Two are situated at the sides and are intended for night soil, which after being drained of liquids, is allowed to fall into the main furnace by opening a sliding damper. An additional hopper leading to a supplementary chamber at the front end of the furnace is used for inflammable material, the heat and flames from which pass directly into the large chamber over the grates, drying and igniting the less inflammable material there. Two lateral chambers are also provided leading into the large furnace in which wood and coal may be used, either in starting the fires or in emergencies when the garbage to be destroyed is particularly wet and difficult to burn. The smoke and gases from the main furnace pass out near the top at the back end, and in passing through holes in a fire brick wall inside a brick lined steel chamber, come in contact with the bricks, which soon become white hot. Thence they pass onwards and reaching the floor level strike a water bath which catches the greater part of the suspended matters. Passing upward again they pass through between an upper down-draft, and a lower up-draft fire of coal, and taking a downward course, again strike another water bath into which a steam jet plays from above and finally they reach the steel smoke-stack which is 125 feet high and 4 feet in diameter.

Having thus briefly described the incinerator itself, I shall now proceed to relate our experience since August when it began operations. Though the plant was not primarily intended as a manure destructor, it has on account of the impossibility of disposing of this product in any other way, been worked to its full capacity both night and day. It destroys on an average about forty tons per day, sometimes running far above its capacity of fifty tons in the 24 hours. Of the material destroyed at least 90 per cent. is manure, and it requires a staff of one engineer, and five workmen to man it, two of these being engaged on a night shift.

The wages of these men, together with wood, coal, repairs, light and telephone come to about $450 per month, on the average, and thus the actual cost of destroying all material is about 45 cents per ton.

If, however, the manure had a commercial value as a fertilizer as would be the case in eastern cities, one workman together with the engineer would be ample, and an incinerator of this capacity would be sufficient for a city of at least 50,000 population, or about double the present population of Edmonton, and would destroy all ordinary household garbage, dead animals, offal from slaughter houses in an effective manner without producing any noxious odors whatever. While this incinerator at present does destroy a portion of our night soil from a few pit closets which unfortunately, cannot be dispensed with, our experience does not lead us to recommend this method of destroying such material in a city where a system of sewers is laid down.



We are rapidly extending our lines of sewers and endeavoring to keep pace with our rapidly growing city, and it is our intention to deposit all night soil and liquid garbage in manholes suitably located in different parts of the city, as the most satisfactory way of dealing with this difficulty.

While the De Cary Incinerator we have installed has fulfilled all requirements as a non-offensive destructor, the large proportion of wet manure we are compelled to receive sometimes taxes its capacity to the limit, and to guarantee an efficient draft in all kinds of weather, and to increase its efficiency, we are arranging to have a motor and fan added to the smoke-stack at an early date. This it is expected will increase the capacity of our plant by at least 50 per cent.

The annual cost of our scavenging department is high in proportion to our present population and will probably

(Continued on Page 136.)

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CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto. President, C. A. Jeffers, Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, R. H. Campbell, Ottawa.

DOMINION LAND SURVEYORS.—Ottawa, Ont. Secretary, T. Nash.

EDMONTON ENGINEERING SOCIETY.—President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alta.

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian Members of Council:—Profs. F. D. Adams, J. B. Porter, H. E. T. Haultain, and W. H. Miller, and Messrs. W. H. Trewartha-James and J. B. Tyrrell.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION.—Homer R. Linn, President; Walter A. Sittig, Secretary, 61 Ward Street, Chicago, Ill.

MANITOBA LAND SURVEYORS.—President, Geo. McPhillips; Secretary-Treasurer, C. C. Chataway, Winnipeg, Man.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. H. Winfield; Secretary, S. Fenn, Bedford Row, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, W. H. Pugsley, Richmond Hill, Ont.; secretary, J. E. Farewell, Whitby, Ont.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, Louis Bolton; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que., Secretary, Alcide Chaussé, P.O. Box 259, Montreal, Que.

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. Andrew Allen, President; J. H. Warder, Secretary.

COMING MEETINGS.

Nova Scotia Society of Engineers: September 9 and 10. Third annual meeting at New Glasgow, N.S. S. Fenn, Halifax, N.S., secretary.

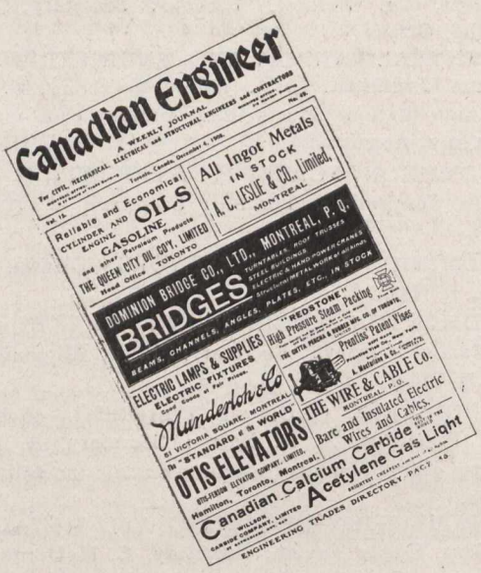
American Railway Bridge and Building Association.—October 19-21. Nineteenth annual convention at Jacksonville, Florida. Secretary, S. F. Patterson, Boston & Maine Railway, Concord, N.H.

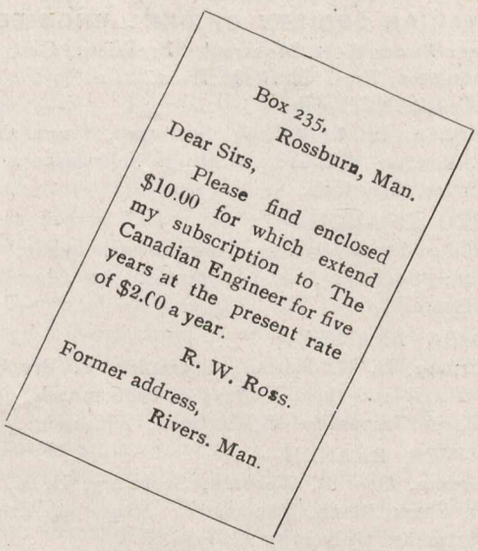
National Irrigation Congress.—Seventeenth meeting, August 9-14, at Spokane, Washington; Arthur Hooker, Secretary, Board of Control, Spokane, Wash.

League of American Municipalities.—August 25-27. Thirteenth annual convention at Montreal, Que. John MacVicar, Secretary, Des Moines, Iowa.

American Society of Municipal Improvements.—November 9-11. Annual convention at Little Rock, Ark., U.S.A. A. Prescott Folwell, Secretary, 241 W. 39th St., New York City.

Royal Architectural Institute of Canada.—October 5-7, at Toronto, general annual assembly. Secretary, Alcide Chaussé R.S.A.; P.O. Box 259, Montreal, Que.





A Generous Response

Already a large number of our old subscribers and some new ones have taken advantage of the offer made to receive new and renewal subscriptions up to August 1st at the old rate of $2.00.

Our Circulation Department report that during the past two or three weeks particularly, the number of renewals for from two to five years has been growing steadily.

Thinking that probably some may have overlooked it we have decided to hold the offer open for another two weeks.

If you want to be sure of the paper for the next few years at the $2.00 rate, please send us by the 15th of August the attached form with your check for any number of years at the old rate.

Extension Subscription Form

Please find enclosed $.....for which extend my subscription for.....years at the present rate of $2.00 a year.

.....

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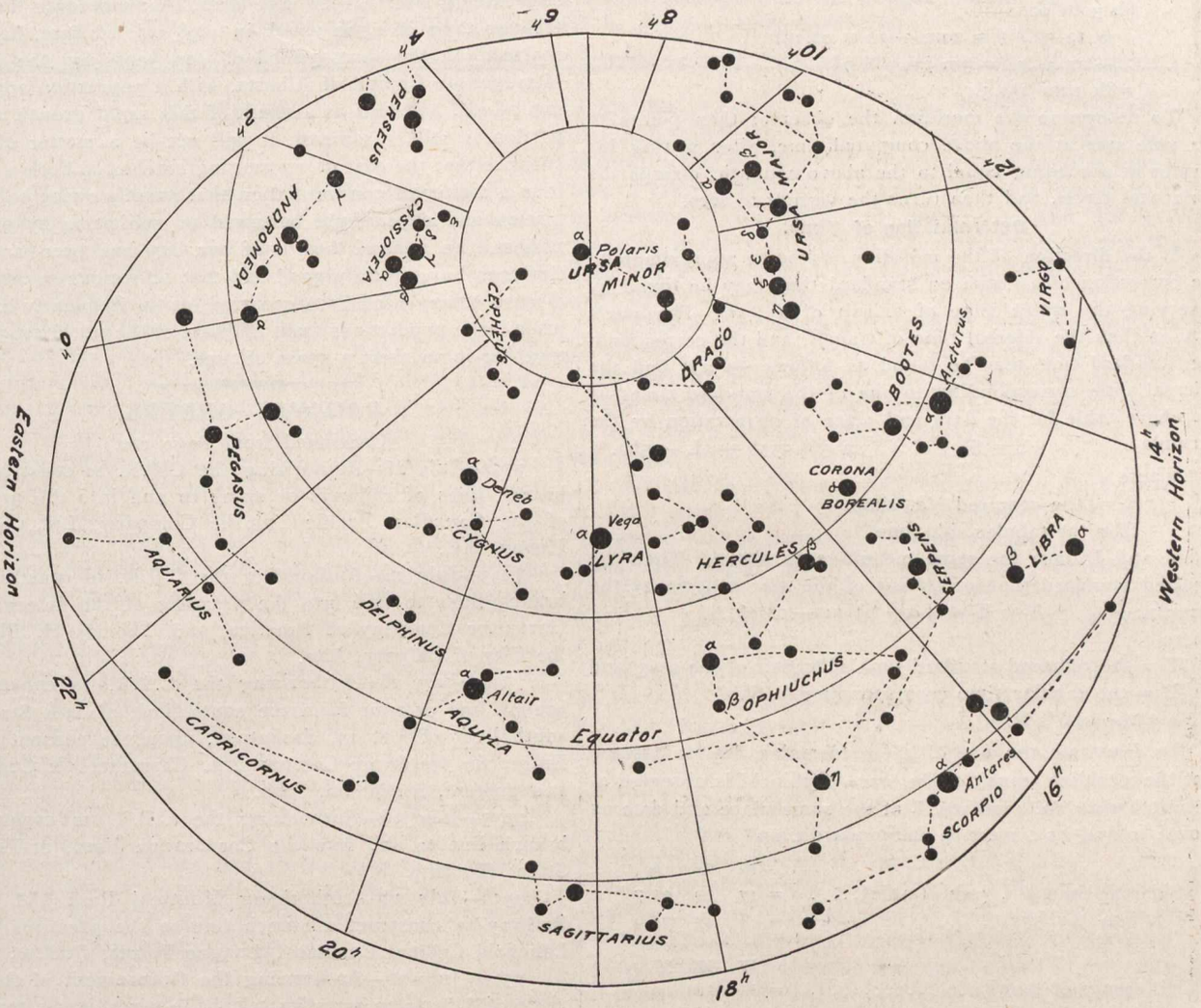
This Application should reach us by August 15th, 1909.

ASTRONOMICAL PAGE



Star Map for August 1st, 1909, 10 p.m.

STAR MAP, SHOWING THE PRINCIPAL STARS, VISIBLE AT 10 P.M., AUGUST 1st, IN LATITUDE 45° N.

L. B. Stewart, D.T.S.

The table below gives the apparent places of the brightest of these stars for August 15th at transit across the meridian of 5h W. of Greenwich.

Star	Mag.	R. A. h. m. s.	Decl. ° ′ ″
α Andromedæ	2.1	0 03 42.9	+ 28 35 23
β Cassiop.	2.4	0 04 21.5	+ 58 38 54
α Cassiop.	2.5	0 35 22.5	+ 56 02 17
γ Cassiop.	2.3	0 51 14.9	+ 60 13 24
α Ursæ Min. (Polaris)	2.1	1 26 58.8	+ 88 49 05
β Ursæ Maj.	2.4	10 56 20.7	+ 56 52 18
α Ursæ Maj.	2.0	10 58 06.3	+ 62 14 38
γ Ursæ Maj.	2.5	11 49 02 5	+ 54 12 10
δ Ursæ Maj.	3.4	12 10 55.2	+ 57 32 26
ε Ursæ Maj.	1.8	12 50 01.5	+ 56 27 23
ζ Ursæ Maj.	2.1	13 20 15 8	+ 55 24 12
η Ursæ Maj.	1.9	13 43 57.5	+ 49 46 12
α Bootis (Arcturus)	0.3	14 11 31.1	+ 19 39 25
α Librœ	2.9	14 45 51.3	— 15 39 56
β Librœ	2.8	15 12 07.5	— 9 02 55
α Ophiuchi	2.1	17 30 44.2	+ 12 37 38
α Lyræ (Vega)	0.1	18 33 53.3	+ 38 42 06
α Aquilœ (Altair)	0.9	19 46 22.7	+ 8 37 47
α Cygni	1.3	20 38 22.1	+ 44 57 26

Determination of Azimuth by the Pole Star.

The following table gives the azimuth of Polaris on August 1st, 1909, for places in longitude 5th (= 75°) W., and at certain standard times T:

T	Sid. Time	Lat. = 44°		Lat. = 48°		Lat. = 52°	
P.M.		A	a	A	a	A	a
h. m.	h. m. s.	° ′ ″	″	° ′ ″	″	° ′ ″	″
8 00	16 39 56.8	1 12 34	+17	1 17 52	+18	1 24 26	+20
8 30	17 10 01.7	20 35	+15	26 30	+16	33 49	+17
9 00	17 40 06.6	27 16	+12	33 41	+12	41 40	+14
9 30	18 10 11.6	32 29	+ 8	39 20	+ 9	47 49	+10
10 00	18 40 16.5	36 08	+ 5	43 17	+ 6	52 11	+ 6
10 30	19 10 21.4	38 10	+ 2	45 31	+ 2	54 38	+ 2
11 00	19 40 26.4	38 31	— 2	45 55	— 2	55 08	— 2
11 30	20 10 31.3	37 10	— 5	44 30	— 5	53 39	— 6
12 00	20 40 36 2	34 07	— 8	41 16	— 9	50 11	—10

In this table azimuths are reckoned from the N. in the direction E.S.W. The quantity a is the error in the azimuth resulting from an error of 1m. in the time. It will serve to show the best time to observe if the watch correction is not well determined. The azimuth for any other latitude may readily be found by interpolation.

The standard time corresponding to any azimuth given in the table for a place whose longtitude differs from 5h, and for some other date, may be found by the formula:—

$$T' = T + (L - 5h)\ (1 - 0s.16) - d \times (3m\ 55s.9).$$

Where

T′ = the required time.

T = the time for August 1st.

L = the longitude.

d = number of days elapsed since August 1st.

The difference L—5h must be algebraic, and in multiplying by 0s.16 it must be expressed in minutes of time.

CUT OUT FOR REFERENCE.

To illustrate this, take the following example:—At a place in latitude 49° 20′ N., longitude 80° (= 5h 20m) W, an observer wishes to take an observation for azimuth between 8 and 9 p.m. on August 8th.

Here the interpolated value of the azimuth for 8h 30m is 1° 28′ 47″, interpolating by second differences, and the corresponding time for the given longitude and date is:—

8h 30m 00s
+ 19 56.8 (= 20m — 20 × 0s.16)
— 27 31.3 (= 3m 55s.9 × 7)
=8h 22m 25s.5.

To determine the meridian the observer then points to the pole star at the above computed time, after setting his vernier at a reading equal to the above azimuth, clamps the horizontal circle, and then turns the vernier to zero.

Determination of Time.

If the direction of the meridian is known approximately, the correction of a watch on standard time may be found by observing the watch time of transit of a star. The star's R.A. is then the sidereal time of transit, and the corresponding standard time may be found as follows:—First find the sidereal time corresponding to one of the standard times of the above table for the date and place of observation by the formula: $S = S' + d \times (3m\ 56s.555) - (L - 5h)$.

Where

S = the required sid. time.
S′ = the tabular sid. time,

and d and L have the same meanings as above. Then the required standard time of transit of the star follows by the formula:— $T = T' + (\alpha - S)\ (1 - 0s.16)$.

Where

T = the required standard time of transit of the star, and
T′ = the tabular time corresponding to S′.
α = the star's R.A.

To illustrate the use of these formulae, let us assume that the meridian transit of the star α Ophiuchi is observed at the watch time 8h. 43m. 16s. 8 at the same place and date as above; to find its correction on standard time.

		h.	m.	s.
Sidereal time, 8h. 30m. (table).....	=	17	10	01.7
7 × (3m 56s. 555)	=		27	35.9
		17	37	37.6
Difference of longitude	=		20	00
S	=	17	17	37.6
R.A. of star	=	17	30	44.2
α — S	=		13	06.6
13.1 × 0s.16	=			2.1
Equivalent mean time interval.....	=		13	04.5
T′	=	8	30	00
T	=	8	43	04.5
Watch	=	8	43	16.8
Watch fast	=			12.3

The methods described above do not take account of changes in the star places, but with ordinary field instruments and for short periods of time these are negligible.

CEMENT BRICK CONSTRUCTION IN THE NEW PLYMOUTH CORDAGE COMPANY'S MILL.

(Continued from Page 127.)

The possibilities of ornamental work with moulded brick and concrete castings are unlimited, but they were not tried by the Plymouth Cordage Co. except as an experiment, for the general design of the building did not call for such detail. The building is notable for its beautiful mild gray color. As compared with clay brick, the cement brick show a strength in compression of 40 pounds more per square inch, and a resistance to disintegration by sand and rain which does not exist in the case of the former. On this plan the cement brick were made at an average cost of 12 per cent. less than clay brick could have been bought for at the time.

GARBAGE DESTRUCTION BY INCINERATOR.

(Continued from Page 132.)

amount to not less than $30,000 for the year 1909. But when it is remembered, that the area of our present city limits is 9,000 acres, and that owing to the generous width of streets and the large size of building lots the settled portion of the city extends over a very wide area, that moreover the small frontier town of 1,500 which in 1898 existed here, has been replaced in the short period of ten years by the present Metropolitan Capital of Alberta, with a population approaching 25,000, and that as a result of this rapid growth a large portion is still unsewered, it will not be a matter of great surprise that the cost of scavenging reaches so high a figure. It is a matter of congratulation that greatly owing to the attention and expenditure bestowed on sanitation by our city fathers, the general health of our city has been and continues to be uniformly good and that no serious epidemics of disease of any kind have occurred, as so frequently happens when large populations from all parts of the world congregate together in so short a space of time.

RAILWAY ORDERS.

(Continued from Page 120.)

7532—July 16—Authorizing the C.P.R. to construct two branch lines of railways or spurs to and into the premises of the Canadian Pacific Lumber Company, Ltd., at Port Moody, B.C.

7533—July 16—Authorizing the C.P.R. to construct two branch lines to and into the premises of the International Harvester Company of America, and Thomas H. Blow, in the City of Calgary, Alta.

7534—July 16—Authorizing the C.P.R. to construct a branch line or spur from the south limit of 24th Street, to south limit of Lot 15, Saskatoon, upon the consent of the Enterprise Hardware Company, A. Carruthers & Company, and Council, Saskatoon, Sask.

7535—July 16—Authorizing the C.P.R. to construct a branch line to and into the Corporation Yard, at Princess Street, Toronto.

7536—July 16—Authorizing Montreal Park and Island Railway to construct a branch line to the premises of the Lakefield Cement Company, Longue Pointe, Quebec.

7537—July 16—Authorizing the Government of the Province of Alberta to carry its telephone wires across tracks of C.N.R. at Raith, Alta.

7538-7539—July 16—Authorizing the Bell Telephone Company to carry its wires across the tracks of the G.T.R., 1¼ miles south of Unionville Station, Ontario; and at Clifford Station, Ontario.

7540—July 16—Authorizing the Creston Power, Light and Telephone Company, at Creston, B.C., to carry its telephone wires across tracks of the C.P.R. at mileage 70.7, about 1,050 feet east of Alice Mine Spur.

7541-7542—July 17—Authorizing the Bell Telephone Company to carry its wires across tracks of C.P.R. at public crossing 300 yards south of Streetsville Junction, Ont.; and at public crossing half mile north of Streetsville Station, Ont.

7543—July 20—Authorizing the C.P.R. to construct branch line to and into premises of the Western Canada Agency, Ltd., Lethbridge, Alta.

7544—July 20—Authorizing the C.P.R. to construct a branch line to and into the premises of J. D. Clark & Company, Winnipeg, Man.

7545—July 20—Authorizing the G.T.R. to construct, maintain and operate a temporary branch line from a point on the Lakefield Branch, Lot 4, Concession 12, Township of Douro, Ont., thence westerly to property of Water Commissioners, City of Peterborough, Ont.

7546—July 20—Authorizing town of Boissevain, Man., to erect electric light wires across tracks of the C.P.R. on Cook Street.

7547—July 20—Authorizing the C.P.R. to construct bridge No. 12.89 on the St. John Section, Atlantic Division.

(Continued on Page 46.)

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS.

Quebec.

CARROLL.—Tenders, marked "Black River Bridge," will be received by the undersigned up to noon Saturday, the 14th of August next, for the construction of a steel bridge on Black River, near Waltham Station, subject to plans and specifications proposed by the Government engineer, Quebec. Address James Coghlan.

MONTREAL.—Tenders, endorsed "Repairs to the Council Chambers," addressed to the city clerk, and deposited in the office of the said city clerk, city hall, will be received until 12 o'clock noon on Wednesday, the 4th of August, 1909, for repairs to be made in the council chambers and ante-rooms, consisting specially of painting and decorating. L. O. David, city clerk.

MONTREAL.—Tenders are invited by the G. T. P. Railway until August 10th for the construction of a 140-mile section of the main line, Kitsilas Canyon to Aldermere, near Hazleton.

MONTREAL.—Tenders will be received until noon, Tuesday, 3rd August, for the supply and delivery at the entrance of the Aqueduct, Lower Lachine Road, of one circular sluice gate of 108 inches diameter, with complete operating mechanism and stand. L. O. David, city clerk.

QUEBEC.—Tenders for electric light wiring and fittings for Postal Station "D," Point St. Charles, Montreal, will be received until 5 p.m. on Tuesday, August 10th, 1909, for the work mentioned. Plans and specification to be seen on application to Mr. Alphonse Piche, Supt. Architect, 52 Victoria Square, Montreal, and at the Department of Public Works, Ottawa. Napoleon Tessier.

Ontario.

CORNWALL.—Tenders for scrap iron will be received up till five o'clock p.m. on Friday, the 30th July, 1909, for scrap iron, both cast and wrought, lying along the line of the Ontario St. Lawrence Canals. W. A. Stewart.

OTTAWA.—Tenders will be received up to August 15 for the furnishing of iron posts for use on the survey of Dominion lands. P. G. Keyes, secretary, Department of the Interior.

OTTAWA.—Tenders will be received up to August 15th, for supplying the lubricating oils required by the Department of Marine and Fisheries for three years. G. J. Desbarats, acting Deputy-Minister of Marine and Fisheries.

OSHAWA.—Tenders wanted for supplying materials and erecting a Y.M.C.A. building in Oshawa. Plans and specifications may be seen at Mr. F. Bull's office, Oshawa, or at the office of C. J. Gibson, 75 Yonge Street, Toronto. Tenders will be closed at 12 o'clock p.m., August 2nd, 1909. T. H. Everson.

TORONTO.—Tenders will be received up to Tuesday, August 3rd, for the construction of reinforced concrete arch of 35-foot span, having a 42-foot roadway, and two 6-foot sidewalks, containing about 1,500 cubic yards of concrete. Joseph Oliver (Mayor), Chairman Board of Control.

TORONTO.—Tenders for new fire hall on Perth Avenue, Toronto, will be received by registered post only, addressed to the undersigned, up to noon on Tuesday, 10th August, 1909: 1. Mason work, etc. 2. Carpenter work. 3. Galvanized iron and roofing. 4. Gasfitting and plumbing. 5. Hot water heating. 6. Glass tiling. 7. Plastering. 8. Painting and glazing. Joseph Oliver, Mayor.

TORONTO.—Tenders for heating and tender for walks, addressed to the Hon. J. O. Reaume, Minister of Public Works, Ontario, Parliament Buildings, Toronto, for alterations and improvements to steam heating plant in the Institution for the Blind at Brantford, and for the construction of cement walks on the grounds of the Normal Schools in Stratford, Peterboro', and North Bay, and for gravel roads on grounds of Normal Schools in Stratford and North Bay, will be received at this Department until noon of July 31st, 1909. H. F. McNaughten.

LINDSAY.—Tenders addressed to the undersigned will be received until 12 o'clock noon of the 5th day of August, 1909, separate or in bulk, for the several trades required in making alterations and additions to the Collegiate Institute in the town of Lindsay, Ont. John Carew.

Manitoba.

WINNIPEG.—Tenders will be received until August 2nd and August 16th for hydraulic, electric, and auxiliary equipment for the generating station at Point du Bois. For plans, etc., apply Smith, Kerry & Chace, engineers, Winnipeg; William Kennedy, jr., Y. M. C. A. Building, Montreal, and M. Peterson, secretary, Board of Control, Winnipeg.

WINNIPEG.—Tenders will be received at the office of the Winnipeg Public School Board up to 5 p.m. on Tuesday, July 27th, for the erection of a stone and brick school on the Greenway site, Livinia Street. R. H. Smith.

WINNIPEG.—Tenders are invited until August 1st for a new Women's Building to be erected on the exhibition grounds. Plans and specifications may be had at the office of D. C. Frame, architect, Five Sisters' Block.

VIRDEN.—Tenders will be received by the undersigned up till 5 p.m. on Tuesday, August 10th, 1909, for the erection of a stone and rick hospital building at the town of Virden. Plans and specifications can be seen at my office in the town of Virden and at the office of Mr. William Gingland, architect, 317 Portage Avenue, Winnipeg. Ida M. Clingan.

WINNIPEG.—Tenders will be received up to 11 a.m. on Monday, August 2nd, for the supply of fence posts of cedar or tamarac for approximately twenty miles of fencing; also for the erection of five-wire fence and gates along both sides of portions of the city's transmission line right-of-way between Bird's Hill and the Brokenhead River. Plans and specifications may be seen at the office of the power engineers Messrs. Smith, Kerry & Chace, Carnegie Library Building, Winnipeg. M. Peterson.

Saskatchewan.

MOOSE JAW.—Tenders will be received until Monday, August 9th, for the construction of a reinforced concrete bridge and abutments. J. Darlington Whitmore, City Engineer. (Advertized in the Canadian Engineer.)

MOOSE JAW.—Tenders will be received until August 9th, for the construction of concrete walks and concrete block crossings. J. Darlington Whitmore, City Engineer. (Advertized in the Canadian Engineer.)

SASKATOON.—Tenders are wanted for the construction of a subway under the C.N.R. tracks. Geo. T. Clark, City Engineer.

SASKATOON.—Tenders will be received by the undersigned up to 5 p.m., Saturday, August 7th, 1909, for the erection of a Collegiate Institute building at Saskatoon, Sask. Each application for plans must be accompanied by a marked cheque for $15 as a deposit, and each tender must be accompanied by a marked cheque for $4,000. Plans, specifications and forms of tender may be obtained at the offices of the architects, Messrs. Storey & Van Egmond, at Saskatoon and Regina. W. P. Bate, secretary-treasurer.

British Columbia.

VICTORIA.—Tenders will be received up to 4 p.m. on Monday, the 16th day of August, 1909, for the supplying of cast-iron water pipe, pig lead, gate valves. The lowest or any tender not necessarily accepted. W. W. Northcott, city hall.

CONTRACTS AWARDED.

Nova Scotia.

SYDNEY.—The United Coke Company, of New York, have secured the contract for the erection of 120 coke ovens for the Dominion Iron and Steel Company, and the work will be started immediately. The new additions will take care of one thousand tons of coal per day, and when this is done it will enable the Steel Company to at once very materially increase its output of the various products of rods, rails, blooms, etc.

Quebec.

MONTREAL.—The Hill Electric Switch and Manufacturing Company have been awarded the contract for panel-boards by the Harbor Commissioners.

ST. LOUIS.—Laurier & Leitch, contractors, secured the contract for asphalt pavements in St. Louis.

WESTMOUNT.—Messrs. Laurie & Lamb, Montreal, Que., have been awarded the contract for a Heenan destructor. This destructor will be capable of destroying fifty tons of refuse per day, and is guaranteed to comply with the requirements of the municipality as to destroying garbage without creating a nuisance.

Ontario.

LONDON.—The Colonial Engineering Company, of Montreal, have secured a contract from C. S. Hyman & Co., of this city, for the installation of 275 horse-power Hornsby-Stockport gas engines. These are guaranteed to produce power, including fixed charges, for $18.80 per horse-power per year.

PORT ARTHUR.—The contract for the construction of the Ontario Government storage dams at the outlet of Dog Lake, on the Kaministiquia River, near Port Arthur, has been signed. Three dams are to be built by White & White, of Burlington, Ont., and a quantity of rock is to be blasted in the channel to permit a greater flow of water. The Legislature voted $40,000 for the work last session.

TORONTO.—The contracts have been awarded for the building of the Niagara Falls step-up transformer station and for the Dundas inter-switching station in connection with the Hydro Electric power scheme, and the successful tenderer is a London firm, John Hagmen & Co., whose tender was the lowest received. For the Niagara building the price received will be $47,700, and for the Dundas station $35,000. Six tenders, differing from highest to lowest by $15,000, were received for the Niagara station, while four, with a difference of $7,000, came in for the inter-switching station at Dundas. The price at which the Government will get the buildings is considerably below the estimated cost.

WATERLOO.—The following tenders were received for the cement coverings of the King Street, Erb Street, and Caroline Street bridges: David Christner, Berlin, $1,650; August May, Berlin, $1,325; Paul Bergmann, Waterloo, $1,218. The lowest was accepted.

Manitoba.

BRANDON.—The Ontario Asphalt Block Co. have secured the contract for paving with asphalt blocks at $2.22 per square yard.

WINNIPEG.—The contract for building the Winnipeg Transfer Railway will likely be awarded to J. W. Buchanan.

Saskatchewan.

REGINA.—The tenders for the construction of the new hospital were as follows: Snyder Bros., Winnipeg, $98,269; Smith Bros. & Wilson, Regina, $107,575; Saskatchewan Building and Construction Co., Limited, Regina, $102,988; Snivean & Dion, Sherbrooke, Que., $105,000; Wilson & Wilson, Regina, $106,430; P. Lyall & Sons, Montreal, $117,000. Snyder Bros. received the contract.

Alberta.

FORT McLEOD.—Another contract has been awarded to Messrs. Foley, Welch & Stewart for the building of the grade of the Grand Trunk Pacific from the McLeod River to Tete Juane Cache, 180 miles. This will place the finished grade fifty miles west of Yellowhead Pass. About the middle of August a contract will be let for 140 miles from Kitsalas Canon to Aldermere in the Buckley Valley. This will leave only 350 miles of a gap in British Columbia to be closed.

British Columbia.

VANCOUVER.—The lowest tenders for the construction of sewers and concrete sidewalks in the Oak Bay municipality were by Albert Pike for sidewalks and H. Murray for sewers. The contracts will be let to them. These are the first cement sidewalks to be constructed in the municipality. The sewers will connect with the city sewers under agreement with the corporation.

VICTORIA.—M. Sabine and D. Stevens have been given a contract for paving Wharf Street at $15,384. H. W. Canova's tender was $20,838.

RAILWAYS—STEAM AND ELECTRIC.

Nova Scotia.

MIDDLETON.—The Lindsay Construction Company is to build a branch railway from Nictaux Falls on the H. & S. W. Railway to the mines at Torbrook.

Quebec.

MONTREAL.—J. M. Shanly, C.E., of this city, who has just returned from a professional trip along the proposed route of the Algoma Central extension to the Transcontinental, is of the opinion that the clay belt through which the G.T.P. runs in Northern Ontario is designed to be a great agricultural country. Mr. Shanly reports that there are 180 miles of the Algoma Central graded, 90 of which are laid with 85-lb. steel rails as far as Michipicoten.

MONTREAL.—Sir Charles Rivers Wilson, President of the Grand Trunk, and other directors, sailed from Liverpool last Thursday. It is their intention to make an inspection trip over the company's lines. They will be joined by Mr. C. M. Hays, the general manager, at Montreal.

MONTREAL.—The Grand Trunk Pacific Railway has called for tenders for the building of a 140-mile section of the main line between Kitsilas Canyon on the Skeena River to Aldermere, a village in the Bulkley Valley, south-east of Hazelton. Bids will be received to August 10.

Ontario.

DUNNVILLE.—By-laws granting aid to the Dunnville Electric Railway were carried on July 26 in the townships of Moulton and Gainsboro', each township voting for a $5,000 bonus.

COBALT.—A new brick passenger station, at a cost of $20,000 to $25,000, is to be commenced immediately here by the Temiskaming and Northern Ontario Railway. A new freight station, costing $10,000, is already in process of construction.

Manitoba.

BRANDON.—The Brandon-Souris branch of the C.P.R. will not be completed this year.

WINNIPEG.—A party of surveyors, who have been engaged running trial lines for the Hudson's Bay Railway in the Nelson country, have just arrived back from the north, bringing a report that would seem to indicate Port Nelson is better suited in every way for the terminus of the road to the bay. The line, according to the surveyors, is shorter and more direct, and the harbour facilites are good and open earlier than at Churchill, while the cost of construction is vastly cheaper than the more northern route. The surveyors estimate that from Split Lake to Nelson the cost of building the line will not greatly exceed that of ordinary prairie work, as there are no muskegs and no grades.

WINNIPEG.—Plans are fast maturing for the commencement of the Grand Trunk Pacific service of passenger trains from Winnipeg to Edmonton, and it is announced that the

service will start on August 15. The steel will reach the Pembina River by the end of September, and the line will be opened this fall right through to that point, carrying passengers seventy miles west of Edmonton. Mr. E. J. Chamberlain, vice-president and general manager will shortly make a trip of inspection over the work at Prince Rupert.

Saskatchewan.

REGINA.—The net result of two sessions betwen the city council and F. W. Peters, representative of the C.P.R., is that Regina is to have a union station. The city agrees to deliver up Stanley Park, consisting of a couple of acres adjoining the present C.P.R. depot, and the company agreed to the erection of a fireproof station to accommodate the C.P.R., G.T.P. and C.N.R.

PRINCE ALBERT.—Fourteen hundred men started work on July 26 on the Sheho-Prince Albert branch of the C.P.R. It is announced that the road will be completed early this fall, and that six hundred men will start work at this end within a week. The plans have been filed at the local registry office.

Alberta.

EDMONTON.—Arrangements are being made by General Manager Chamberlain of the G.T.P. to give out contracts within a short time for the erection of the company's workshops and roundhouses on the main line just north of Edmonton.

CALGARY.—Tenders are being dealt with for the construction of the Grand Trunk Pacific branch from Edmonton to Calgary, and these will be announced very shortly.

British Columbia.

VICTORIA.—The survey for the Victoria and Barkley Sound railway is progressing satisfactorily under the charge of C. Hoard, the engineer in charge. The Barkley Sound railway is regarded by many as a line that would mean more for Victoria than any other line projected.

KAMLOOPS.—Enlargement will be made to the yards of the C.P.R. at this point.

VANCOUVER.—The tenders for the construction and grading of the last section of the British Columbia Electric Railway Company's line between New Westminster and Chilliwack are in the contract for Section 3 between Abbotsford and the Miles district, a distance of 12 miles, and was awarded to the Puget Sound Ditch & Dredging Company, calling for the completion of the work in six months. The contract for the section between Miles and Chilliwack has not yet been awarded.

LIGHT, HEAT, AND POWER.

Ontario.

COBALT.—The Mines Power Limited is constructing a 11,000 horse-power power plant on the Matabitchouan River, 24 miles south-east of Cobalt, at a point where the river has a fall of 300 feet. The construction consists of a concrete dam 10,000 cubic yards, which will create a large storage in the Bass Lakes. Also several other storage dams for other lakes on the watershed. The pipe lines consist of two steel pipes 5 feet in diameter, and the power plant operates under a net working head of 300 feet. The generating equipment, which is being manufactured by the Allis-Chalmers-Bullock Company, Ltd., Montreal, consists of four units of 1,500 k.w. each, normal rating, and four turbines of 2,750 horse-power each at 600 R.P.M. Also two Pelton driven exciters. The governors are being supplied by Jens Orten Boving of Sweden. The transmission system consists of four, 3-phase, step-up transformers, 1,875 K.V.A. each, and three sub-stations, one each at Cobalt, Kerr Lake and South Lorraine, consisting each of four, 3-phase transformers of 1,250 K.V.A., 375 K.V.A. and 312 K.V.A. each respectively. The transformers are being manufactured by the Canadian Westinghouse Company, Toronto. The transmission is at 44,000 volts and will be carried over two 3-phase circuits on separate one pole lines, over a right-of-way 135 ft. wide. Each circuit will be protected by a steel ground wire cable, and there will be a telephone system of one pole line. The transmission cable will be No. 00 aluminum, supplied by the Northern Aluminum Company of America. These works are to supply power to the mines in the Cobalt mining district, and it is expected that they will be complete in the early autumn. The president of the company, Mr. E. A. Wallberg, is constructing the works chiefly by day labor, except the transmission line, which is being erected by the Standard Construction Company, Montreal. The engineers in charge of the survey designs, specifications and construction, Smith, Kerry & Chace, Toronto.

MIDLAND.—The Simcoe Rai'way and Power Company will soon proceed with the development of the Big Chute on the Severn River, thirty miles from here. A staff of engineers under the direction of C. H. and P. H. Mitchell, of Toronto, have been making extensive surveys at the site and along the route of the transmission lines. It is expected that about 4,000 horse-power can be developed and distributed in this vicinity.

ORANGEVILLE.—The Dufferin Light & Power Company is completing its transmission line from Shelburne to Orangeville, is installing a 100 k.w. single phase transformer at Orangeville, and is increasing its generating equipment at Horning's Mills. This company supplies lighting load to Shelburne and Orangeville, and transformation equipment is being built with a view to the erection of a larger power house in the near future. The president of this company is Wm. D. Wilson. Engineers in charge of design and construction of the works, Messrs. Smith, Kerry & Chace, Toronto.

NORTH BAY.—The Nipissing Power Company, Ltd., is constructing a power plant on the South River, 19 miles south of North Bay, to supply North Bay and vicinity with electric power. The works at present being constructed are as follows: Permanent concrete head works; ⅓-ft. wooden stave pipe 3,000 ft. long (giving an operating head of 90 ft.); a steel stand pipe for more effective regulation; a concrete and brick power house, with an equipment of two 450 K.V.A. generators, two 925 horse-power turbines. The transmission will be at 22,000 volts on wooden poles and an an aluminum transmission line circuit protected by steel ground wire cable. The step-up station will be equipped with three 300 K.V.A. single-phase transformers 2,200-22,000 volts. The terminal station in North Bay will have three 450 K.V.A. single-phase transformers, Scott connected. The entire electrical equipment is being supplied by the Canadian Westinghouse Company, and the turbine by the Jenckes Machine Company. The president of this company is C. B. Smith, Esq., andl the works are being constructed by day labor. It is expected that power will be delivered in North Bay in December. These works are being designed and constructed under the supervision of Smith, Kerry & Chace, engineers, Toronto.

PORT HOPE.—Mr. J. A. Culverwell, Managing Director of the Northumberland Durham Power Company, lessee of the Healey Falls Power from the Dominion Government, in company with the two engineers of the capitalists who are financing the development of the Healey Falls and other Trent Powers and the Cobourg, Port Hope and Havelock Electric Railway Company have just completed a tour of the power sites. The capitalists are friends of Mr. H. T. Bush, President of the Standard Sanitary Ideal Company and the Central Foundry Company, Port Hope. The Healey Falls power will be developed by the Dominion Government canal dam about to be constructed, and the water will be taken through the upper canal cutting and at the first lock discharged into pipes to the power house below. A head of 76 feet will be developed, and power supplied to Belleville, Port Hope, and Cobourg, and other lake front towns and cities. Eighteen councils have officially endorsed the company and the Government in the securing of the lease. The other powers which will be developed in unison are located at Campbellford and Trenton and are owned by some of the shareholders of the above company. Altogether some 20,000 horse-power will be developed in the dry season at the different dams.

CURRENT NEWS.

Ontario.

HAMILTON.—The B. Greening Wire Company, Hamilton, have instructed their architect, Mr. W. A. Edwards, of same city, to prepare plans for a new wire rope factory. It will be a one-story concrete and brick structure, 124′ x 112′, with saw tooth roof construction. The flooring will be solid concrete so as to withstand the weights of heavy machinery and large reels of cable. It will be an up-to-date factory in every respect. Orders have been placed for additional rope machinery of the very latest design. It is expected the new mill will be completed and machinery installed by first November next. The present rope mill will be used as an extension of the wire working branch of the business, and will provide much needed room for the rapidly growing demand for their wire guards, garden fencing, and bordering, factory lockers, etc.

SEWERAGE AND WATERWORKS.

Ontario.

LONDON.—The by-law to expend $100,000 in the wells drilled by Hon. Adam Beck to increase the water supply carried July 26th by 1,800 majority. The by-law to extend the mains was defeated.

STRATFORD.—Mayor Dingman, Alderman Savage, and City Engineer Ferguson last week submitted to the Provincial Board of Health the city's plans for extensions to its sewage disposal plant. The sum of $25,000 has been voted for this purpose. Stratford uses bacteria beds in conjunction with its septic tanks, and is now enlarging the beds and improving the system of treatment.

COBALT.—Plans prepared by Messrs. Galt & Smith, of Toronto, for water supply and sewage disposal at Cobalt have been approved by the Provincial Board of Health. The scheme provides for the procuring of water from Sasaginaga Lake, a considerable body of fresh water lying north of the town. The plans also provide for a system of treating sewage by sedimentation and by secondary treatment.

RAINY RIVER.—At a recent meeting of the Provincial Board of Health, a Rainy River deputation submitted plans for waterworks and sewage disposal. Their plans provided for the treatment of sewage before it was discharged into the river. The town will draw its water supply from a point above the town.

FINANCING PUBLIC WORKS.

British Columbia.

LADYSMITH.—This municipality has sold debentures amounting to $75,000 for installation of an electric light plant and for sewage disposal works.

VANCOUVER.—The municipality of Richmond, B.C., is discussing several by-laws, including one relative to water supply. Mr. W. Bridge is reeve.

VICTORIA.—The city council have passed a by-law of $1,350,000 for the purpose of taking over the property of the Esquimalt Waterworks Company.

Ontario.

BRACEBRIDGE.—The town of Bracebridge will place the by-law for $45,000 before the people on August 2nd, for the construction of an hydro-electric plant at Wilson's Falls on the Muskoka River, about a mile above the town. This plant is to run in parallel with the two present hydro-electric plants, and will make about 2,000 horse-power available for municipal and manufacturing purposes. The work is in charge of C. H. and P. H. Mitchell, Toronto, who had charge of the construction of the second plant some years ago. The new plant will have a single unit of 600 Kilowatts capacity.

PERSONAL.

MR. ALGERNON P. SEYMOUR, mining engineer, has been appointed superintendent of the Cobalt Lake Company, the position made vacant by the death of E. L. Fraleck.

MR. GUY BOYER has been appointed superintendent of construction for the Montreal Street Railway Company.

MR. JAMES P. GORDON is resident engineer at Estevan, Sask., for Mr. Willis Chipman, C.E., who is installing a complete waterworks system.

MR. E. M. PROCTOR, B.A.Sc., has been appointed resident waterworks engineer under Mr. Willis Chipman at Weyburn, Sask. A complete waterworks system is being installed.

MR. C. LeB. MILES, C.E., of Woodstock, N.B., has been appointed superintendent of construction on Manitoulin and North Shore Railway for the O'Boyle Bros. Construction Company.

MR. L. R. KINGHORN, of the Montreal Rolling Mills, is leaving Montreal for British Columbia.

MR. GERALD HALL, C.E., of Peterboro', Ont., is home on his vacation. Mr. Hall is a graduate of the Royal Military College, and has been engaged in important engineering work in Porto Rico.

MR. H. G. NICHOLLS, who has for several years been assistant general manager of the Canadian General Electric Company and the Canada Foundry Company, has resigned that position to go into business for himself. He has organized a company called "Factory Products, Limited," with offices in the Confederation Life Building, Toronto, for the purpose of acting as Canadian selling agents for representative manufacturers.

MARKET CONDITIONS.

Toronto, 29th July, 1909.

There is some talk of a rise in iron pipe in Canada, to follow the rise established by some American mills; but the United States Steel Company has not made any alteration. Improved earnings by the United States Steel Company are indicated by the increase of dividend on common stock to the annual rate of 3 per cent. Increased activity does not yet suffice, however, to raise prices in the States. Advices of July 17th from London and Glasgow say that the pig-iron warrant market is steady; but prices of makers' iron are described as unsatisfactory. "The galvanized sheet combine is reported to-day to be at an end for the present, so that prices will be open. "We do not change quotations here, however, as any change in price has not yet reached this market. Land is steady, sheet zinc firm, copper, uncertain.

Structural materials in Toronto maintain their prices, as a rule. Lumber is moderately active, bricks decidedly so, cement still suffering from over-production. Roofing materials and building papers not so active as in other seasons. General business in metals and hardware is for the most part inactive, but stone, lime, sand, and sewer-pipe are moving steadily, mostly in small parcels to city builders.

The following are wholesale prices for Toronto, where not otherwise explained, although for broken quantities higher prices are quoted:—

Antimony.—Demand inactive, market unchanged at $9 per 100 lbs.

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9.

Bar Iron.—$1.95 to $2, base, per 100 lbs., from stock to wholesale dealer. Market well supplied.

Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15; 4-inch, $18.50 to $19 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. The spring rush is over and business steady.

Bricks.—Business is very active, price at some yards $9 to $9.50, at others, $9.50 to $10, for common. Don Valley pressed brick move also freely. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—Cement is being offered at the low price of $1.55 per barrel in car lots, including cotton bags. The consumption in Canada is between three and four million barrels, while the capacity of production of Canadian plants is nearly eight million. Until the consumption increases, prices can hardly be firm. Smaller dealers report a fair movement in small lots at $1.40 to $1.50 per barrel in load lots delivered in town, bags extra. In packages, $1.40 to $1.50, including paper bags.

Coal.—Retail price for Pennsylvania hard, $6.50, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.50. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.25 to $5.50; Reynoldsville, $4.50 to $4.75; Connellsville, 72-hour coke, $5.25 to $5.50.

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(Continued from Page 140.)

Copper Ingot.—Unchanged and quiet at $13.85 to $14.05 per 100 lbs. Speculative handling put it down a trifle, but it recovered as above.

Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $2.

Dynamite, per pound, 21 to 25c., as to quantity.

Roofing Felt.—Unseasonably quiet, price maintained at $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000. The demand is steady and stocks light.

Fuses.—Electric Blasting.—Double strength 4 feet, $4.50; 6 feet, $5; 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5, per 100 count. Bennett's double tape fuse, $6 per 1,000 feet.

Galvanized Sheets.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.05; 12-14-gauge, $3.15; 16, 18, 20, $3.35; 22-24, $3.50; 26, $3.75; 28, $4.20; 29, $4.50; 10¾, $4.50 per 100 lbs. Fleur de Lis—28-gauge, $4.30; 26-gauge, $4.05; 22-24-gauge, $3.50. Queen's Head—28-gauge, $4.50; 26-gauge, $4.25, per 100 lbs. Sheets continue in active request.

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ¾-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch. $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—Black, ¼-inch, $2.03; ⅜-inch, $2.26; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.90; 2½-inch, $15.81; 3-inch, $20.76; 3½-inch, $26.13; 4-inch, $29.70; 4½-inch, $38; 5-inch, $43.50; 6-inch, $56. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.50, per 100 feet. Some talk of an advance in price.

Lead.—Prices steady outside. This market is rather weaker, at $3.75 to $3.85 per 100 lbs.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car. In active demand.

Lumber.—Considerable demand for both Southern and Canadian dimension pine continues; hemlock dull. Prices are rather stiff all along the line. Dressing pine quotes $32 to $35 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22; shingles, British Columbia, $3.20; lath, No. 1, $4.25; No. 2, $3.75; for white pine, 48-inch; for 32-inch, $1.60, and very few to be had.

Nails.—Wire, $2.25 base; cut, $2.70; spikes, $3, per keg of 100 lbs.

Pitch and Tar.—Pitch, demand moderate, price so far unchanged at 70c. per 100 lbs. Coal tar quotes $3.50 per barrel.

Pig Iron.—There is fair activity and prices are maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21; in Canadian pig, Hamilton quotes $19.50 to $20 per ton.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, wholesale, $2; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.05.

Ready Roofing.—In moderate request at prices per catalogue. It is impracticable to quote figures, so great is the variety of this kind of goods, but prices are steady.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Pennsylvania slate 10 x 16 may be quoted at $7.25 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less.

Rope.—Sisal, 9½c. per lb.; pure Manila, 12½c. per lb., Base.

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

Not much moving; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. Small lots subject to advance.

Steel Beams and Channels.—Quiet. We quote:—$2.50 to $2.75 per 100 lbs., according to size and quantity; if cut $2.75 to $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees.

Steel Rails.—80-lb., $35 to $38 per ton. The following are prices per gross ton, for 500 tons or over: Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $42.

Sheet Steel.—Market steady, at the former prices; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge, $2.85. Quite a quantity of light sheets moving.

Tank Plate.—3-16-inch, $2.40 per 100 lbs.

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c.

Tin.—Prices steady and demand good. The price continues at 31c. to 31½c.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, per dozen, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each.

Zinc Spelter.—A very active movement continues, and the market is firm at $5.50 to $5.75.

CAMP SUPPLIES.

Beans.—Hand Picked, $2.60 to $2.70; prime, $2.40 to $2.50; Rangoon, hand-picked, $1.90 to $2.

Butter.—Dairy prints, 20 to 21c.; creamery rolls, 24 to 25c.

Canned Goods—Peas, 77½ to $1.12½; tomatoes, 2s, 85 to 90c.; tomatoes, 3s, 95c. to $1; pumpkins, 3s, 80 to 85c.; corn, 85 to 95c.; peaches, 2s, white, $1.80 to $1.85; yellow, $1.00 to $1.05; strawberries, 2s, heavy syrup, $1.00 to $1.05; raspberries, 2s, $1.90 to $1.95.

Cheese.—Old cheese, 15c. for large; 15½c. for twins; new cheese, large, 12¾c.; twins, 13c.

Coffee.—Rio, green, 10 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c.

Dried Fruits.—Raisins, Valencia, new, 5½ to 6c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, 7½ to 8c.; fancy, 11 to 12c.; extra fancy, 14½ to 15c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 12 to 15c. per lb.; prunes, 60s to 70s, 7 to 7½c.; 90s to 100s, 6½c.; evaporated apples, 7½c.

Eggs.—New laid, 22c. per dozen, in case lots.

Lard.—Tierces, 14½c.; tub, 14¾c.; pails, 15c.

Molasses.—Barbadoes, barrels, 37 to 45c.; Porto Rico, 45 to 60c.; New Orleans, 30 to 33c. for medium.

Potatoes.—Ontario, old, 75 to 90c. per bag in car lots on track.

Rice.—B grade, 3½c. per lb.; Patna, 5½ to 5¾c.; Japan, 5¼ to 6c.

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75.

Spices.—Allspice, 16 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c.

Sugar.—Granulated, $4.70 per 100 lbs. in barrels.; Acadia, $4.60; yellow, $4.30; bags, 5c. lower; bright coffee, $4.60; bags, 5c. less.

Syrup.—Corn syrup, special bright, 3½c. per lb.

Teas.—Japans, 18 to 35c .per lb.; Young Hysons, 16 to 35c.; Ceylons, medium, 16 to 45c.

* * * *

Montreal, July 29th, 1909.

The pig-iron situation in the United States continues in a satisfactory position. Demand is holding up well, and prices are practically as high as they have been at any time this season. This is a very encouraging sign, for the reason that at this time of the year the trade always expects a considerable diminution in the quantity of iron required, and consequently a disposition on the part of producers to shade prices. This season, however, prices are holding up well and holders are demanding from 25c. to 50c. per ton more for future deliveries. Railways are buying more freely, not only in track material but in rolling stock as well, and the outlook is in every way hopeful.

The English market is certainly not very bright, at the moment. The feature over there, as explained in letters just received from English and Scotch correspondents, is that the coal miners, throughout the whole country, are contemplating a strike, and it was feared that cessation of work would be general by the 26th of July. Up to that date, fortunately, no definite action had been taken, so far as heard of here. However, the correspondents considered the threat a very serious one, as they wrote their customers on this side of the Atlantic, calling their attention to the strike clauses in their contracts, and stating that they might be compelled to take advantage of them.

The local market is principally concerned in the possibility of a general coal strike in England and Scotland. Should such take place, it would have the effect of shutting off imports of pig into Canada, and as Canadian furnaces had previously announced themselves as out of the market, and as they have probably been further hamperd by the present coal strike going on in Canada, the effect would be to boost prices of pig-iron very considerably in this country. It has been stated here that, should the strike at the Dominion Coal Company, at Glace Bay, continue long enough to restrict the supply of coal for the Dominion Iron and Steel Company, the latter company would have no difficulty in drawing its supplies from the United States. Unfortunately, it now seems that the strikers are bringing pressure to bear upon Baltimore and Pennsylvania dock laborers' unions in order to have them refuse to load coal destined for the relief of the Glace Bay strike situation. Under the circumstances it is not to be wondered that holders of pig-iron are exceedingly firm in their views and are more disposed to advance prices at the moment than to accept even present quotations. In fact, there is little doubt that an advance will take place immediately upon advices of a strike in England.

The steadiness of the local market for finished and semi-finished iron and steel products is exceptional, having been almost uninterrupted for weeks past. This week, again, no actual change has taken place though there are predictions of a number of alterations in the near future:—

Antimony.—The market is steady at 8¾ to 9c.

Bar Iron and Steel.—Prices are steady and trade is quiet. Bar iron, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild steel, $1.85; sleigh shoe steel, $1.85 for 1 x ¾-base; tire steel, $1.90 for 1 x ¾-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; smooth finish, $2.70; imported, $2.20.

Boiler Tubes.—The market is steady, quotations being as follows:—1½ and 2-inch tubes, 8½c.; 2¼-inch, 10c.; 3-inch, 11½c.; 3 1-2-inch, 14¾c.; 4-inch, 19c.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—The market is steady as follows:—¼-inch, $5.30; 5-16-inch, $4.05; ⅜-inch, $3.65; 7-16-inch, $3.45; ½-inch, $3.20; 9-16-inch, $3.15; ⅝-inch, $3.05; ¾-inch, $3; ⅞-inch, $2.95; 1 inch, $2.95.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal.

Copper.—Prices are strong at 13¾ to 14c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1. Electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting,